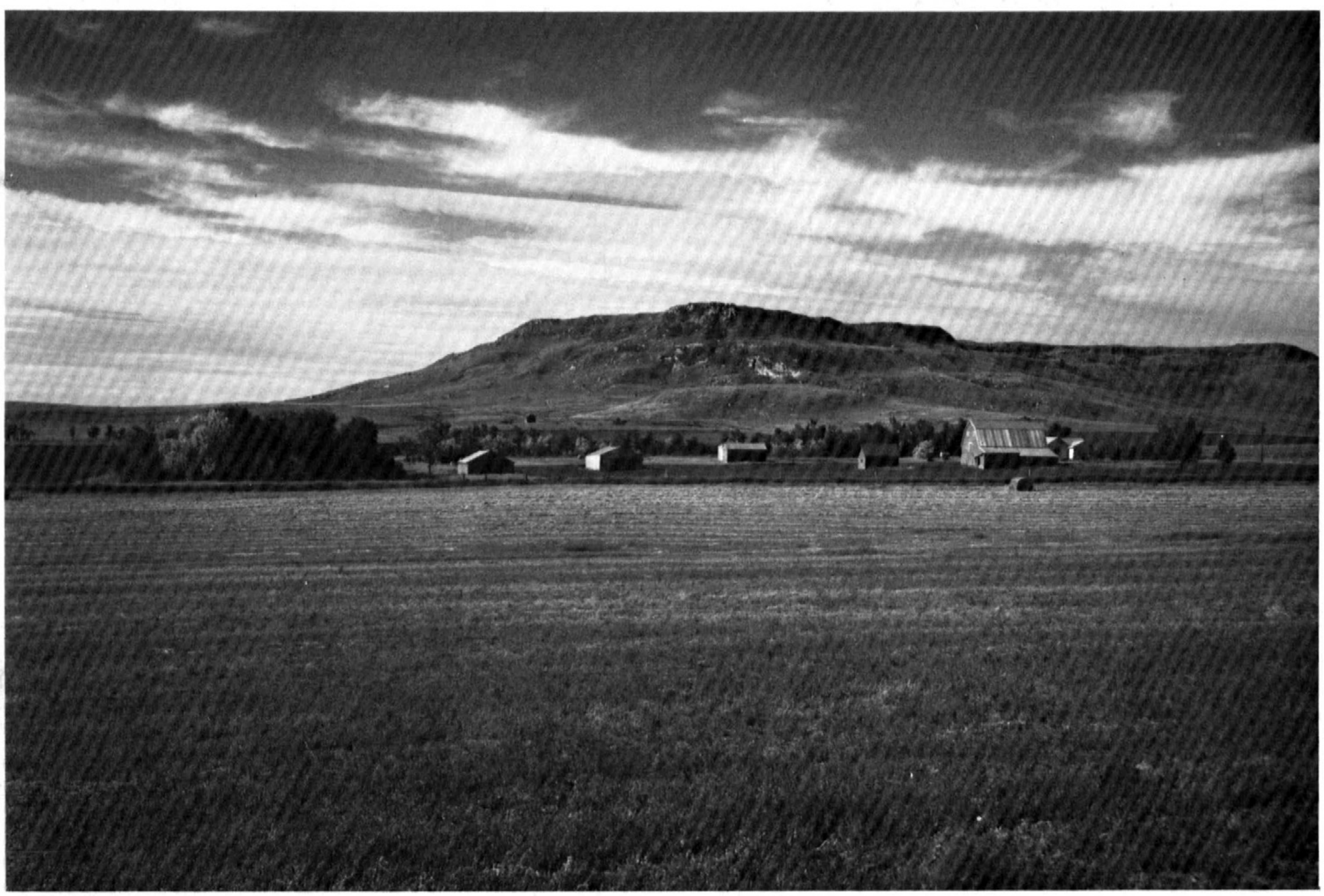
United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
North Dakota Agricultural
Experiment Station, North
Dakota Cooperative
Extension Service, and
North Dakota State Soil
Conservation Committee

Soil Survey of Hettinger County, North Dakota



How To Use This Soil Survey

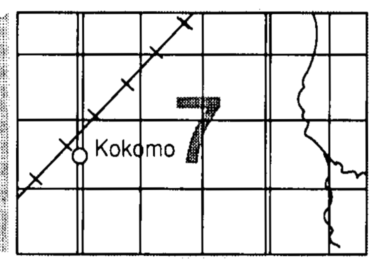
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

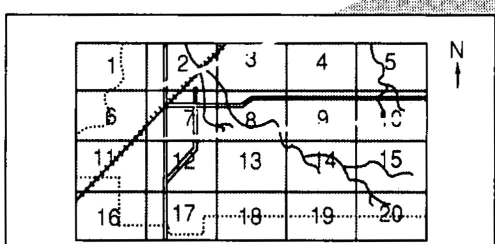
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



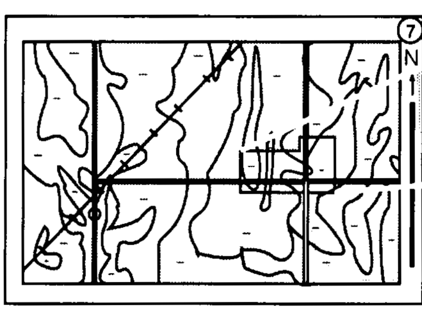
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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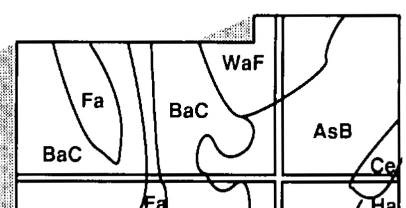

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service and the North Dakota Agricultural Experiment Station, the North Dakota Cooperative Extension Service, and the North Dakota State Soil Conservation Committee. It is part of the technical assistance furnished to the Slope-Hettinger Soil Conservation District. Financial assistance was provided by the Hettinger County Board of Commissioners, the Hettinger County Water Resource District, the Slope-Hettinger Soil Conservation District, and the North Dakota Department of Universities and School Lands.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Grasses and legumes in an area of Yegen fine sandy loam, 1 to 6 percent slopes. Black Butte is in the background.

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Issued May 1990

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Hettinger County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Ronnie L. Clark
State Conservationist
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Soil Survey of
Hettinger County, North Dakota

By Michael G. Ulmer and P. Michael Whited, Soil Conservation Service

Fieldwork by Jerome Schaar, Kenneth W. Thompson, and M. Robert Wright, Soil Conservation Service; Thomas Krapf, North Dakota State Soil Conservation Committee; and Wesley Larsen and Francis J. Wilhelm, professional soil classifiers

Map finishing by David W. Hickcox and Steven S. Kranich, North Dakota State Soil Conservation Committee

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
North Dakota Agricultural Experiment Station, North Dakota Cooperative Extension Service,
and North Dakota State Soil Conservation Committee

HETTINGER COUNTY is in the southwestern part of North Dakota (fig. 1). The county has a total area of 726,400 acres, or 1,135 square miles. It has 4,480 acres of water. It is bordered on the south by Adams County, on the east by Grant County, on the north by Grant and Stark Counties, and on the west by Slope County. The county seat and largest town is Mott.

The county is part of the Rolling Soft Shale Plain of the Northern Great Plains Spring Wheat Region *(21)*. It is within the Missouri River basin. Chantapeta, Timber, and Thirty Mile Creeks and the Cannonball River flow through the county in a northwesterly to southeasterly direction. Among the prominent landmarks in the county are Black Butte, Northstar Butte, Tepee Buttes, and White Butte.

Farming and ranching are the main economic enterprises. The principal crops are spring wheat, sunflower, barley, and hay *(12)*.

About 80 percent of the area is cropland, and 20 percent is rangeland and other land. Irrigation is limited to small areas adjacent to the major streams. About one-third of the cropland is fallowed every year. The climate is semiarid.

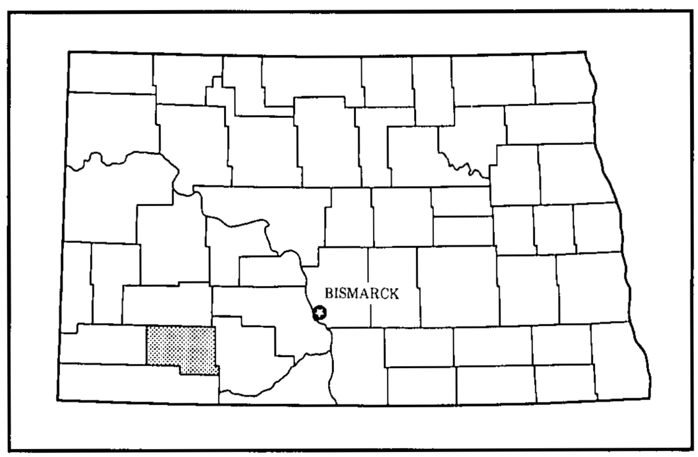

Figure 1.—Location of Hettinger County in North Dakota.

The soils in the county are mostly deep or moderately deep and are suited to cultivated crops. Some of the soils contain salts or sodium, and many of them are highly susceptible to soil blowing and water

erosion if they are not protected.

The first soil survey of a part of Hettinger County was published in 1907 *(17)*. The entire area of the county was included in a survey published in 1908 *(11)*. A general soil survey of Hettinger County was published in 1968 *(15)*. The present survey updates the earlier surveys, provides additional information and larger scale maps, and shows the soils in more detail.

General Nature of the County

This section provides general information about the history and development; physiography, relief, and drainage; natural resources; and climate of Hettinger County.

History and Development

The area that was to become Hettinger County was at one time part of the vast tract of land that was included in the Louisiana Purchase. In 1889 it became a part of the state of North Dakota. It was organized into its present area in 1907 *(4)*.

Ranching became prominent in the area around the turn of the century, along with the collection of buffalo bones for fertilizer products and bone meal. Most of the cattle were longhorns brought in from Texas or Wyoming. The number of sheep also gradually increased during this period. Land survey and township organization began in the area in 1883 and was completed in 1902 *(4)*. Settlement followed the railroads into the area, and homesteading was largely completed by 1907. At that time about 4,000 people resided in the county.

In 1910 there were 1,325 farms in Hettinger County. By 1950 the number had declined to 890. Today, fewer than 500 farms remain. Population likewise has declined. The Slope-Hettinger Soil Conservation District was organized in 1938 to address the soil erosion problems in the county. Today, agriculture remains the main industry. Spring wheat, barley, and sunflowers are the most important crops, although winter wheat is becoming more popular. The acreage of rangeland and pastureland has steadily decreased.

Physiography, Relief, and Drainage

Hettinger County is in the unglaciated Missouri Plateau section of the Great Plains physiographic province *(21)*. The area is a moderately dissected rolling plain that is underlain mainly by calcareous shale, siltstone, and sandstone. It has generally low relief that is characterized by gentle slopes interrupted by low buttes or ridges. Strongly dissected areas with sharp local relief and steep slopes border stream valleys in some places. Elevation at Mott is 2,407 feet. The highest point in the county, at 3,025 feet, is Black Butte; the lowest point, at 2,250 feet, is the bed of the Cannonball River, at the eastern border of the county.

Drainage of the county is by numerous small, intermittent streams in three main watersheds. The Heart River watershed, in the northeastern part of the county, drains about 67,120 acres. The Cedar River watershed, including Chantapeta and Timber Creeks, drains about 156,150 acres in the southwestern and southeastern parts of the county. The Cannonball River watershed, including Thirty Mile, Coal Bank, Dead Horse, and Indian Creeks, drains about 503,120 acres in the center of the county. None of these streams is deeply entrenched. Distinct benches or terraces are present along the Cannonball River. The highest terrace commonly is underlain by sand or gravel deposits.

Natural Resources

Soil is the most important natural resource in the county. It provides a growing medium for cultivated crops and for the grass grazed by livestock.

The water supply in Hettinger County comes from both surface and ground water sources. The main sources of surface water are local streams such as Thirty Mile Creek, Chantapeta Creek, and the Cannonball River. The main sources of ground water in the county are the upper Ludlow and the Tongue River aquifer systems and the Sentinel Butte aquifer system. The water of these aquifer systems generally is unsuitable for irrigation because it contains an excessive amount of sodium. The water generally is light brown in color and has more than 1,000 parts per million of dissolved solids. These aquifer systems yield 1 to 75 gallons per minute.

Other ground water sources in Hettinger County are the Fox Hills-Basal Hell Creek and the upper Hell Creek-lower Ludlow aquifer systems *(16)*. Neither of these aquifers has water of quality that is considered desirable for irrigation. Small quantities of water for domestic and livestock use are also available from local deposits of Quaternary sand and gravel.

Other natural resources in Hettinger County are coal and coal products. Lignite was mined in the county extensively prior to 1951, but the mines have all been abandoned. The lignite beds with the most potential for mining are the Coal Bank Creek bed in the vicinity of Havelock and the Harmon bed near Mott *(14)*. The

strippable reserves of lignite in Hettinger County are estimated to be 1 billion tons *(5)*.

Hettinger County is on the southern flank of the Williston Basin, a region in which oil exploration and development have been extensive *(5)*. Most of the wells that are producing oil are to the west or north of Hettinger County. Many test holes have been drilled in the county, but there is only one well that is producing oil at this time.

Sand and gravel deposits occur in the county that are suitable for asphaltic concrete mixtures or for graveling road surfaces. These gravel deposits are on stream terraces or escarpments and are variable in quality. Gravel suitable for concrete mixtures is not known to be present in the county *(8)*.

Porcellanite, or scoria, is another surfacing material used on some county roads, especially in parts of the county where gravel deposits are not present. The quality of scoria for road use varies a great deal, with the hardest deposits being the most useful.

The potential exists for limestone to be mined from some flat-topped buttes in the north-central part of the county; however, the limestone is only of fair quality for cement, and large amounts of overburden would have to be removed.

Clay from a member of the Golden Valley Formation is high in kaolinite and could possibly be used for ceramics. The Golden Valley Formation is extensive in the northwestern part of the county *(5)*.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Hettinger County usually is quite warm in summer. It is marked by frequent spells of hot weather and occasional cool days. It is very cold in winter, when arctic air frequently surges over the area. Precipitation falls mainly during the warm period and normally is heaviest late in spring and early in summer. Winter snowfall usually is not very heavy, and it is blown into drifts so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Mott in the period 1951-81. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 16 degrees F and the average daily minimum temperature is 4 degrees. The lowest temperature on record, which occurred at Mott on February 28, 1962, is -44 degrees. In summer, the average temperature is 67 degrees and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Mott on July 8, 1981, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 16 inches. Of this, 12 inches, or 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 3.24 inches at Mott on June 25, 1969. Thunderstorms occur on about 34 days each year, and most occur in summer. Small, scattered areas receive hail during thunderstorms.

The average seasonal snowfall is about 30 inches. The greatest snow depth at any one time during the period of record was 37 inches. On the average, 52 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. Several times each winter, storms with snow and high winds bring blizzard conditions to the county.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the west-northwest. Average windspeed is highest, 12 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil

formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the

map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

Survey Procedures

The general procedures used to make this soil survey are described in the National Soils Handbook and the *Soil Survey Manual (19)*. The *Soil Survey of Western North Dakota (11)*; *Soil Survey of the Morton Area, North Dakota (17)*; *The Major Soils of North Dakota (13)*; *Soil Survey Report, County General Soil Maps, North Dakota (15)*; and *Geology and Ground-Water Resources of Hettinger and Stark Counties, North Dakota (18)*, were among the references used to gather background information for this soil survey.

All soil mapping was done on field sheets developed from high-altitude aerial photographs made in 1975. The scale of the field sheets was 1:20,000, or 3.168 inches to the mile. The detail of these field sheets was checked with older aerial photographs and, in some instances, with topographic maps.

The soil delineations were drawn on the field sheets by traversing the land on foot, by pickup with a mounted hydraulic soil probe, or by three-wheel, all-terrain cycles. The traverses were planned to cross all major landforms and were at intervals close enough to locate contrasting soil areas of about 3 to 5 acres. The soils were examined to a depth of 3 to 5 feet, depending on the kind of soil. Soil properties, including color, texture, structure, horizonation, presence of salts and stones, and depth to soft bedrock, were examined.

All map units were characterized for soil variability by transecting representative areas. A transect is a series of detailed soil examinations done in a map unit delineation to determine the range of composition of various kinds of soil and soil properties. The transect procedure used was the point-intercept method *(10)*. One transect was required for each 1,000 acres of the unit mapped.

The transect data were analyzed by a statistical method *(3)*. This analysis indicates that the range in the percent composition of the named soils and similar soils is at least 90 percent accurate.

Each map unit was documented by at least three soil profile descriptions for each soil series identified in its name. These profile descriptions were used to determine the range in characteristics of each soil series.

Soil characterization or engineering test data from 27 soil pedons were sampled. The soil analyses were made by the North Dakota State University Soil Characterization Laboratory and the North Dakota State Highway Department. Additional soil laboratory data from adjacent counties were also available.

Yield data for wheat and sunflowers were collected for several years. Information was gathered on the Cabba, Regent, Grail, Flasher, Vebar, Parshall, and Arnegard soils.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

As a result of changes in soil series concepts, differing soil patterns, and differences in the design of map units, some of the boundaries and soil names on the Hettinger County general soil map do not match those on the general soil maps of Adams, Grant, Slope, and Stark Counties.

Soil Descriptions

Deep to Shallow, Loamy and Sandy Soils on Uplands

These soils formed in alluvium and in material weathered from soft sandstone. They make up about 25 percent of the county. Most areas are used for cultivated crops or range. The soils are suited to cultivated crops and well suited to range. The main concerns in managing cultivated areas are controlling soil blowing and conserving moisture. The main concerns in managing range are achieving uniform distribution of grazing, maintaining an adequate cover of the important forage plants, and controlling soil blowing.

1. Parshall-Vebar-Shambo Association

Deep and moderately deep, nearly level to moderately sloping, well drained, loamy soils

This association is on side slopes, foot slopes, and toe slopes of uplands. Most areas are drained by entrenched, intermittent streams. Slope ranges from 1 to 9 percent.

This association makes up about 19 percent of the county. It is about 25 percent Parshall and similar soils, 20 percent Vebar and similar soils, 17 percent Shambo and similar soils, and 38 percent soils of minor extent.

The nearly level and gently sloping, deep Parshall soils are on side slopes and foot slopes. They are lower on the landscape than the Vebar soils and higher than the Shambo soils. Typically, the surface soil is fine sandy loam about 10 inches thick. The subsoil to a depth of about 60 inches is fine sandy loam.

The nearly level to moderately sloping, moderately deep Vebar soils are on side slopes. They are higher on the landscape than the Parshall and Shambo soils. Typically, the surface layer is fine sandy loam about 6 inches thick. The subsoil is fine sandy loam about 26 inches thick. Below this is soft sandstone.

The nearly level and gently sloping, deep Shambo soils are on foot slopes and toe slopes. They are lower on the landscape than the Parshall and Vebar soils. Typically, the surface layer is loam about 6 inches thick. The subsoil is about 39 inches thick. It is loam in the upper part and clay loam in the lower part. The substratum to a depth of about 60 inches is clay loam.

Belfield, Daglum, Flasher, and Regan are the minor soils in this association. The level and gently sloping Belfield and Daglum soils have a dense, alkali subsoil. They are on foot slopes and broad flats. The moderately sloping to very steep Flasher soils are shallow. They are on hills and ridges. The Regan soils are level and nearly level, are poorly drained, and

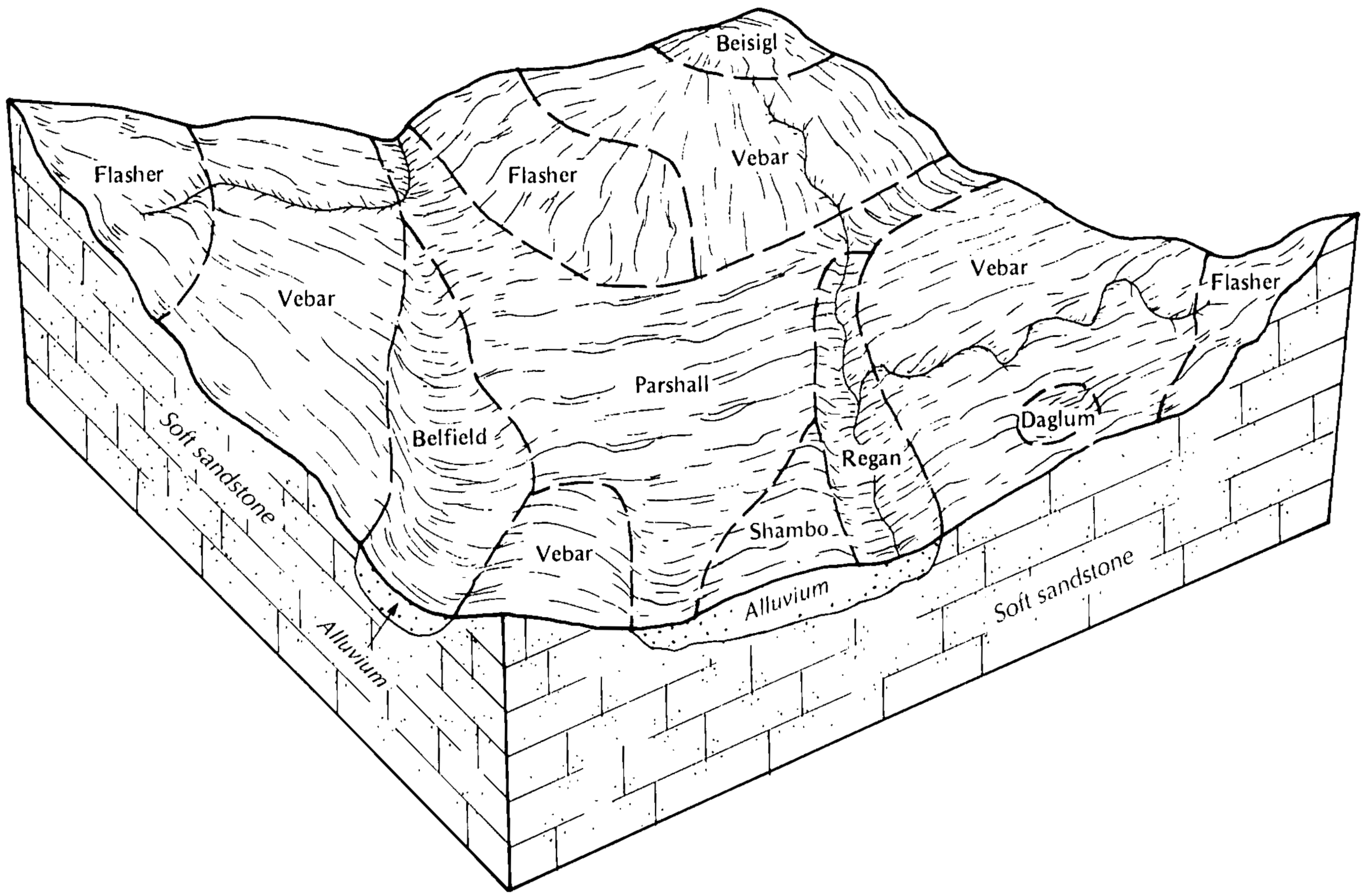

Figure 2.—Typical pattern of soils and underlying material in the Vebar-Parshall-Flasher association.

are in swales and adjacent to drainageways.

Most areas of this association are used for cultivated crops; however, the steeper areas are used for hay, pasture, or range. The hazard of soil blowing is severe, and that of water erosion is moderate. Droughtiness in the Parshall and Vebar soils and soil blowing are the main concerns for agricultural uses.

This association is well suited to range, hay, and pasture and is suited to cultivated crops.

2. Vebar-Parshall-Flasher Association

Deep to shallow, nearly level to very steep, well drained and somewhat excessively drained, loamy and sandy soils

This association is on side slopes, foot slopes, toe slopes, hills, and ridges. Most areas are drained by entrenched, intermittent streams. Slope ranges from 1 to 70 percent.

This association makes up about 6 percent of the county. It is about 23 percent Vebar and similar soils, 23 percent Parshall and similar soils, 22 percent Flasher and similar soils, and 32 percent soils of minor extent (fig. 2).

The nearly level to moderately steep, moderately deep, well drained Vebar soils are on side slopes. They are higher on the landscape than the Parshall soils and lower than the Flasher soils. Typically, the surface layer is fine sandy loam about 6 inches thick. The subsoil is fine sandy loam about 26 inches thick. Below this is sandstone.

The nearly level to moderately sloping, deep, well drained Parshall soils are on foot slopes and toe slopes. They are lower on the landscape than the Vebar and Flasher soils. Typically, the surface soil is fine sandy loam about 10 inches thick. The subsoil to a depth of about 60 inches is fine sandy loam.

The gently sloping to very steep, shallow, somewhat

excessively drained Flasher soils are on ridges and hills. They are higher on the landscape than the Vebar and Parshall soils. Typically, the surface layer is loamy fine sand or fine sandy loam about 4 inches thick. The next layer is loamy fine sand about 11 inches thick. Below this is soft sandstone.

Beisigl, Belfield, Daglum, Regan, and Shambo are the minor soils in this association. The nearly level to steep Beisigl soils have a loamy fine sand surface layer. They are on side slopes. The nearly level and gently sloping Belfield and Daglum soils have a dense, alkali subsoil. They are on foot slopes. The Regan soils are level and nearly level, are poorly drained, and are in swales and adjacent to drainageways. The nearly level and gently sloping Shambo soils have a loam surface layer and subsoil. They are on foot slopes.

Most areas of this association are used for range; however, some nearly level and gently sloping areas are used for cultivated crops. The hazard of soil blowing is severe, and that of water erosion is moderate. Droughtiness, limited rooting depth, and soil blowing are the main concerns for agricultural uses.

This association is well suited to range. The less sloping areas of Vebar and Parshall soils are suited to cultivated crops, hay, and pasture.

Deep to Shallow, Loamy and Silty Soils on Uplands

These soils formed in alluvium and in material weathered from soft siltstone, mudstone, and sandstone. They make up about 20 percent of the county. Most areas are used for cultivated crops; however, the steeper areas generally are used as range. The deep and moderately deep, level to moderately sloping soils are suited to cultivated crops. All of the soils are well suited to range. The main concerns in managing cultivated areas are maintaining tilth, controlling erosion, and conserving moisture. The main concerns in managing range are achieving uniform distribution of grazing and maintaining an adequate cover of the desirable forage plants.

3. Amor-Belfield-Cabba Association

Deep to shallow, level to very steep, well drained and moderately well drained, loamy soils

This association is on foot slopes, side slopes, hills, and ridges. Most areas are drained by entrenched, intermittent streams. Slope ranges from 0 to 70 percent.

This association makes up about 7 percent of the county. It is about 27 percent Amor and similar soils, 24 percent Belfield and similar soils, 14 percent Cabba and similar soils, and 35 percent soils of minor extent.

The nearly level to strongly sloping, moderately deep, well drained Amor soils are on side slopes. They are lower on the landscape than the Cabba soils and higher than the Belfield soils. Typically, the surface layer is loam about 5 inches thick. The subsoil is loam about 18 inches thick. The substratum to a depth of about 30 inches is loam. Below this is soft mudstone.

The level to gently sloping, deep, well drained and moderately well drained, alkali Belfield soils are on foot slopes. They are lower on the landscape than the Amor and Cabba soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches thick. The substratum to a depth of about 60 inches is clay loam.

The moderately sloping to very steep, shallow, well drained Cabba soils are on hills and ridges. They are higher on the landscape than the Amor and Belfield soils. Typically, the surface layer is loam about 4 inches thick. The next layer is loam about 5 inches thick. The substratum to a depth of about 13 inches is loam. Below this is soft siltstone.

Arnegard, Daglum, Regent, Shambo, and Straw are the minor soils in this association. The nearly level Arnegard soils are deep. They are in swales. The nearly level and gently sloping Daglum soils have a dense, alkali subsoil. They are on foot slopes. The nearly level to moderately sloping Regent soils have a silty clay loam surface layer and subsoil. They are on mid and lower side slopes. The nearly level and gently sloping Shambo soils are loam throughout. They are on foot slopes. The Straw soils have a loam surface soil and a clay loam substratum. They are on dissected, narrow flood plains.

This association is used for cultivated crops and range. The hazard of soil blowing is slight, and that of water erosion is severe. Droughtiness, steepness of slope, and limited rooting depth are the main concerns for agricultural uses.

This association is suited to cultivated crops, hay, and pasture and is well suited to range.

4. Cabba-Savage-Amor Association

Shallow to deep, nearly level to very steep, well drained, loamy soils

This association is on foot slopes, side slopes, hills, ridges, and buttes. Most areas are dissected by numerous shallow drainageways. Slope ranges from 1 to 70 percent.

This association makes up about 1 percent of the county. It is about 30 percent Cabba and similar soils, 22 percent Savage and similar soils, 13 percent Amor and similar soils, and 35 percent soils of minor extent.

The moderately sloping to very steep, shallow Cabba soils are on hills, ridges, and shoulders of buttes. They are higher on the landscape than the Amor and Savage soils. Typically, the surface layer is loam about 4 inches thick. The next layer is loam about 5 inches thick. The substratum to a depth of about 13 inches is loam. Below this is soft siltstone.

The nearly level to strongly sloping, deep Savage soils are on foot slopes and lower side slopes. They are lower on the landscape than the Amor and Cabba soils. Typically, the surface layer is clay loam about 7 inches thick. The subsoil is about 44 inches thick. It is silty clay in the upper part and silty clay loam in the lower part. The substratum to a depth of about 60 inches is silty clay loam.

The nearly level to moderately steep, moderately deep Amor soils are on upper and mid side slopes. They are lower on the landscape than the Cabba soils and higher than the Savage soils. Typically, the surface layer is loam about 5 inches thick. The subsoil is loam about 18 inches thick. The substratum to a depth of about 30 inches is loam. Below this is soft mudstone.

Brandenburg, Daglum, Regent, Sinnigam, and Vebar are the minor soils in this association. The moderately sloping to very steep Brandenburg soils have a porcellanite (scoria) substratum. They are on knobs. The nearly level to moderately steep Daglum soils have a dense, alkali subsoil. They are on foot slopes, on side slopes, and in microdepressions on summits of buttes. The gently sloping and moderately sloping Regent soils have a silty clay loam surface layer and subsoil. They are on lower and mid side slopes. The nearly level and gently sloping Sinnigam soils are shallow. They are on summits and shoulders of buttes. The gently sloping to strongly sloping Vebar soils have a fine sandy loam surface layer and subsoil. They are on upper and mid side slopes.

Most of this association is used for range. The hazard of soil blowing is moderate, and that of water erosion is severe. Droughtiness, limited rooting depth, and steepness of slope are the main concerns for agricultural uses.

This association is well suited to range. The less sloping areas of Amor and Savage soils are suited to hay and pasture. This association is poorly suited to cultivated crops.

5. Felor-Amor-Cabba Association

Deep to shallow, nearly level to very steep, well drained, loamy soils

This association is on side slopes and summits of buttes. Numerous short drainageways are incised into the side slopes. Slope ranges from 1 to 70 percent.

This association makes up about 3 percent of the county. It is about 35 percent Felor and similar soils, 26 percent Amor soils, 15 percent Cabba and similar soils, and 24 percent soils of minor extent.

The nearly level and gently sloping, deep Felor soils are on summits of buttes. They are higher on the landscape than the Amor and Cabba soils. Typically, the surface layer is loam about 4 inches thick. The subsoil is about 37 inches thick. It is loam in the upper part, clay loam in the next part, and silty clay in the lower part. The substratum to a depth of about 60 inches is silty clay.

The nearly level to moderately steep, moderately deep Amor soils are on side slopes. They are lower on the landscape than the Cabba and Felor soils. Typically, the surface layer is loam about 5 inches thick. The subsoil is loam about 25 inches thick. The substratum to a depth of about 30 inches is loam. Below this is soft mudstone.

The moderately sloping to very steep, shallow Cabba soils are on upper side slopes and shoulders of buttes. They are higher on the landscape than the Amor soils and lower than the Felor soils. Typically, the surface layer is loam about 4 inches thick. The next layer is loam about 5 inches thick. The substratum to a depth of about 13 inches is loam. Below this is soft siltstone.

Daglum, Heil, Regent, and Vebar are the minor soils in this association. The nearly level and gently sloping Daglum soils have a dense, alkali subsoil. They are on foot slopes and in microdepressions on summits of buttes. The poorly drained Heil soils are in depressions. They are level. The nearly level to moderately sloping Regent soils have a silty clay loam surface layer and subsoil. They are on side slopes. The nearly level to moderately steep Vebar soils have a fine sandy loam surface layer and subsoil. They are on side slopes.

This association is used for cultivated crops and range. The hazard of soil blowing is moderate, and that of water erosion is severe. Droughtiness, limited rooting depth, and steepness of slope are the main concerns for agricultural uses.

This association is well suited to range. The less sloping areas of Felor and similar soils are suited to hay, pasture, and cultivated crops.

6. Chama-Belfield-Cabba Association

Deep to shallow, level to very steep, well drained and moderately well drained, silty and loamy soils

This association is on foot slopes, side slopes, hills, and ridges. Most areas are drained by entrenched, intermittent streams. Slope ranges from 0 to 70 percent.

This association makes up about 9 percent of the county. It is about 40 percent Chama and similar soils, 16 percent Belfield and similar soils, 13 percent Cabba and similar soils, and 31 percent soils of minor extent.

The nearly level to steep, moderately deep, well drained Chama soils are on side slopes. They are higher on the landscape than the Belfield soils and lower than the Cabba soils. Typically, the surface layer is silt loam about 6 inches thick. The subsoil is about 25 inches thick. It is silt loam in the upper part and silty clay loam in the lower part. Below this is soft siltstone.

The level to gently sloping, deep, well drained and moderately well drained, alkali Belfield soils are on foot slopes. They are lower on the landscape than the Chama and Cabba soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches thick. The substratum to a depth of about 60 inches is clay loam.

The moderately sloping to very steep, shallow, well drained Cabba soils are on hills and ridges. They are higher on the landscape than the Belfield and Chama soils. Typically, the surface layer is silt loam about 4 inches thick. The next layer is loam about 5 inches thick. The substratum to a depth of about 13 inches is loam. Below this is soft siltstone.

Daglum, Harriet, Parshall, Regent, and Shambo are the minor soils in this association. The nearly level and gently sloping Daglum soils have a dense, alkali subsoil. They are on foot slopes. The poorly drained Harriet soils are on narrow flood plains. They are level. The nearly level and gently sloping Parshall soils have a fine sandy loam surface layer and subsoil. They are in swales. The nearly level to moderately sloping Regent soils have a silty clay loam surface layer and subsoil. They are on side slopes. The nearly level and gently sloping Shambo soils have a loam surface layer and subsoil. They are on lower side slopes.

Most areas of this association are used for cultivated crops; however, the steeper areas are used for hay, pasture, or range. The hazards of soil blowing and water erosion are severe. Droughtiness, steepness of slope, and limited rooting depth are the main concerns for agricultural uses.

This association is well suited to range, hay, and pasture and is suited to cultivated crops.

Moderately Deep and Deep, Clayey and Loamy Soils on Uplands

These soils formed in material weathered from soft shale, sandstone, siltstone, and mudstone and in alluvium. They make up about 9 percent of the county. Most areas are used for cultivated crops; however, some areas are used for range, pasture, or wetland wildlife habitat. The soils are suited to cultivated crops and well suited to range. The main concerns in managing cultivated areas are controlling water erosion and conserving moisture. The main concerns in managing range and pasture are achieving uniform distribution of grazing and maintaining an adequate cover of the important or introduced forage plants. The main concerns in managing wetland wildlife habitat are maintaining the natural wetness and controlling siltation.

7. Moreau-Lawther-Amor Association

Moderately deep and deep, nearly level to moderately sloping, well drained and moderately well drained, clayey and loamy soils

This association is on broad flats, low knolls, foot slopes, and side slopes of uplands. Most areas are drained by shallow, intermittent streams. Slope ranges from 1 to 9 percent.

This association makes up about 8 percent of the county. It is about 36 percent Moreau and similar soils, 30 percent Lawther and similar soils, 15 percent Amor and similar soils, and 19 percent soils of minor extent (fig. 3).

The nearly level and gently sloping, moderately deep, well drained and moderately well drained Moreau soils are on side slopes and low knolls. They are higher on the landscape than the Lawther soils and lower than the Amor soils. Typically, the surface layer is silty clay about 4 inches thick. The subsoil is about 31 inches thick. It is silty clay in the upper part and channery silty clay in the lower part. Below this is soft shale.

The nearly level, deep, well drained Lawther soils are on foot slopes and broad flats. They are lower on the landscape than the Amor and Moreau soils. Typically, the surface layer is silty clay about 8 inches thick. The subsoil is about 34 inches thick. It is clay in the upper part and silty clay in the lower part. The substratum to a depth of about 60 inches is silty clay.

The nearly level to moderately sloping, moderately deep, well drained Amor soils are on side slopes. They are higher on the landscape than the Moreau and

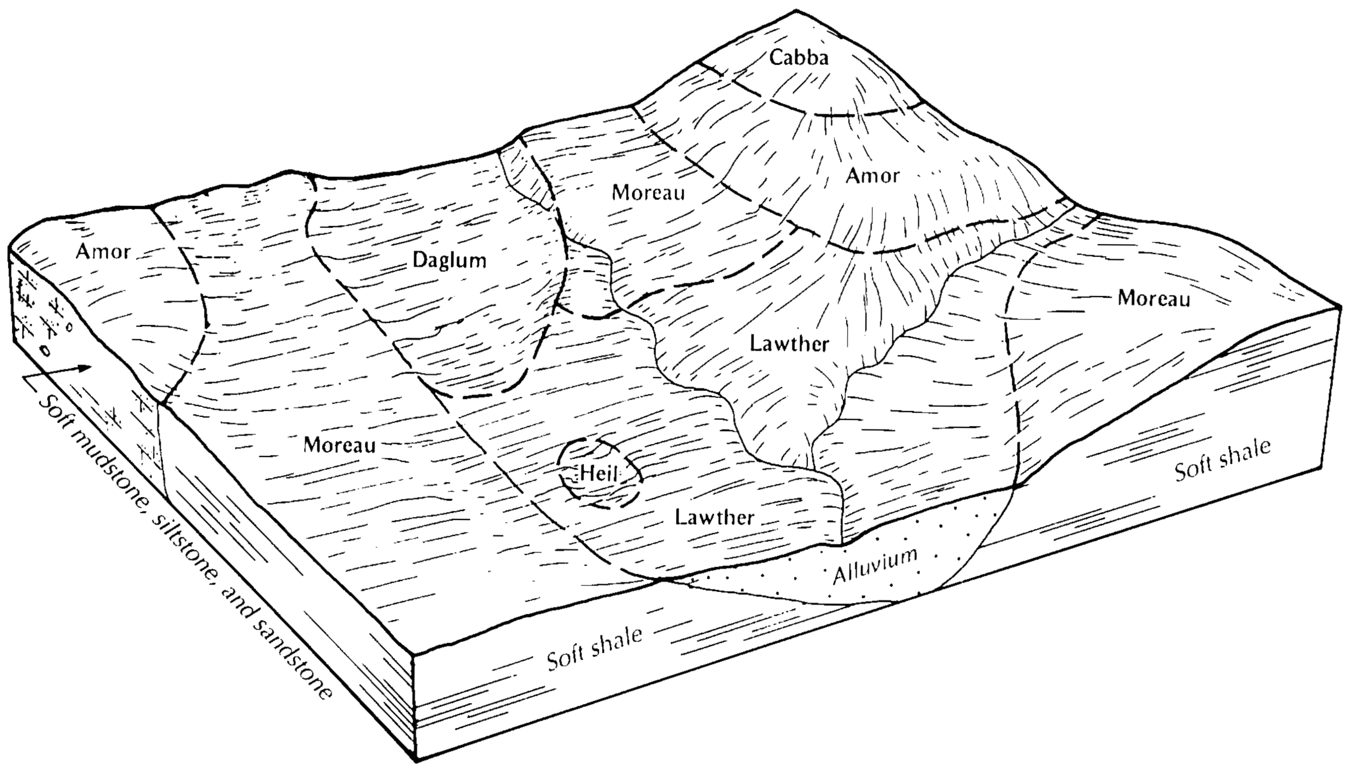

Figure 3.—Typical pattern of soils and underlying material in the Moreau-Lawther-Amor association.

Lawther soils. Typically, the surface layer is loam about 5 inches thick. The subsoil is loam about 18 inches thick. The substratum to a depth of about 30 inches is loam. Below this is soft mudstone.

Cabba, Daglum, Heil, and Vebar are the minor soils in this association. The moderately sloping to strongly sloping Cabba soils are shallow. They are on hills and ridges. The nearly level and gently sloping Daglum soils have a dense, alkali subsoil. They are on foot slopes. The level Heil soils are poorly drained. They are in depressions. The nearly level to moderately sloping Vebar soils have a fine sandy loam surface layer and subsoil. They are on side slopes.

Most of this association is used for cultivated crops. The hazard of soil blowing is moderate, and that of water erosion is severe. Droughtiness, water erosion, the presence of soluble salts, and limited rooting depth are the main concerns for agricultural uses.

This association is well suited to range, hay, and pasture and is suited to cultivated crops.

8. Dimmick-Belfield-Reeder Association

Deep and moderately deep, level to gently sloping, very poorly drained, well drained, and moderately well drained, clayey and loamy soils

This association is in basins and swales and on rises and flats of uplands. Most areas drain into broad depressions. Slope ranges from 0 to 6 percent.

This association makes up about 1 percent of the county. It is about 26 percent Dimmick and similar soils, 24 percent Belfield and similar soils, 23 percent Reeder and similar soils, and 27 percent soils of minor extent.

The level, deep, very poorly drained Dimmick soils are in basins. They are lower on the landscape than the Belfield and Reeder soils. Typically, the surface soil is mottled and is about 14 inches thick. It has a cover of partially decomposed leaves, twigs, and roots. It is silty clay in the upper part and clay in the lower part. The subsoil is clay about 17 inches thick. The substratum to a depth of about 60 inches is mottled clay.

The level to gently sloping, deep, well drained and moderately well drained Belfield soils are on flats and in swales. They are higher on the landscape than the Dimmick soils and lower than the Reeder soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches

thick. The substratum to a depth of about 60 inches is clay loam.

The nearly level and gently sloping, moderately deep, well drained Reeder soils are on rises. They are higher on the landscape than the Dimmick and Belfield soils. Typically, the surface layer is loam about 6 inches thick. The subsoil is about 20 inches thick. It is clay loam in the upper part and silt loam in the lower part. Below this is soft siltstone.

Cabba, Daglum, Felor, Parshall, and Regent are the minor soils in this association. The moderately sloping to steep Cabba soils are shallow. They are on ridges and hills. The nearly level to gently sloping Daglum soils have a dense, alkali subsoil. They occur as areas intermingled with areas of the Belfield soils. The nearly level to gently sloping Felor soils have a loam surface layer, a clay loam subsoil, and a silty clay substratum. They are on terraces. The nearly level to gently sloping Parshall soils have a fine sandy loam surface layer and subsoil. They are on terraces. The nearly level to moderately sloping Regent soils have a silty clay loam surface layer and subsoil. They are on side slopes.

Most of this association is used for wildlife habitat and cultivated crops. The hazards of soil blowing and water erosion are moderate. The presence of sodium salts in the Belfield soils, limited rooting depth in the Reeder soils, and ponding and wetness in the Dimmick soils are the main concerns for agricultural uses.

The Dimmick soils are unsuited to cultivated crops unless they are drained. They are suited to range and hay. The Belfield and Reeder soils are well suited to range, hay, pasture, and cultivated crops.

Deep and Moderately Deep, Loamy and Silty Soils on Uplands

These soils formed in alluvium and in material weathered from soft shale, sandstone, siltstone, and mudstone. They make up about 38 percent of the county. Most areas are used for cultivated crops; however, some areas are used for range. The soils are suited to cultivated crops and well suited to range. The main concerns in managing cultivated areas are improving rooting depth, conserving moisture, and controlling water erosion. The main concerns in managing range are achieving uniform distribution of grazing, developing nonsalty watering facilities, and maintaining an adequate cover of the important forage plants.

9. Belfield-Amor-Regent Association

Deep and moderately deep, level to strongly sloping, well drained and moderately well drained, loamy and silty soils

This association is on foot slopes, side slopes, and ridges. Most areas are drained by shallow, intermittent streams. Slope ranges from 0 to 15 percent.

This association makes up about 31 percent of the county. It is about 27 percent Belfield and similar soils, 25 percent Amor and similar soils, 18 percent Regent and similar soils, and 30 percent soils of minor extent (fig. 4).

The level to gently sloping, deep, well drained and moderately well drained, alkali Belfield soils are on foot slopes. They are lower on the landscape than the Amor and Regent soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches thick. The substratum to a depth of about 60 inches is clay loam.

The nearly level to strongly sloping, moderately deep, well drained Amor soils are on upper and mid side slopes. They are higher on the landscape than the Belfield and Regent soils. Typically, the surface layer is loam about 5 inches thick. The subsoil is loam about 18 inches thick. The substratum to a depth of about 30 inches is loam. Below this is soft mudstone.

The nearly level to moderately sloping, moderately deep, well drained Regent soils are on lower and mid side slopes. They are lower on the landscape than the Amor soils and higher than the Belfield soils. Typically, the surface layer is silty clay loam about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. Below this is soft shale.

Arnegard, Cabba, Daglum, Harriet, and Vebar are the minor soils in this association. The nearly level Arnegard soils are deep and have a loam surface layer and subsoil. They are in swales. The moderately sloping to very steep Cabba soils are shallow. They are on hills and ridges. The nearly level and gently sloping Daglum soils have a dense, alkali subsoil. They are on foot slopes. The level Harriet soils are poorly drained. They are on narrow flood plains. The nearly level to moderately sloping Vebar soils have a fine sandy loam surface layer and subsoil. They are on side slopes.

Most of this association is used for cultivated crops. The hazard of water erosion is moderate, and that of soil blowing is severe. The presence of sodium salts and limited rooting depth are the main concerns for agricultural uses.

This association is well suited to cultivated crops, hay, pasture, and range.

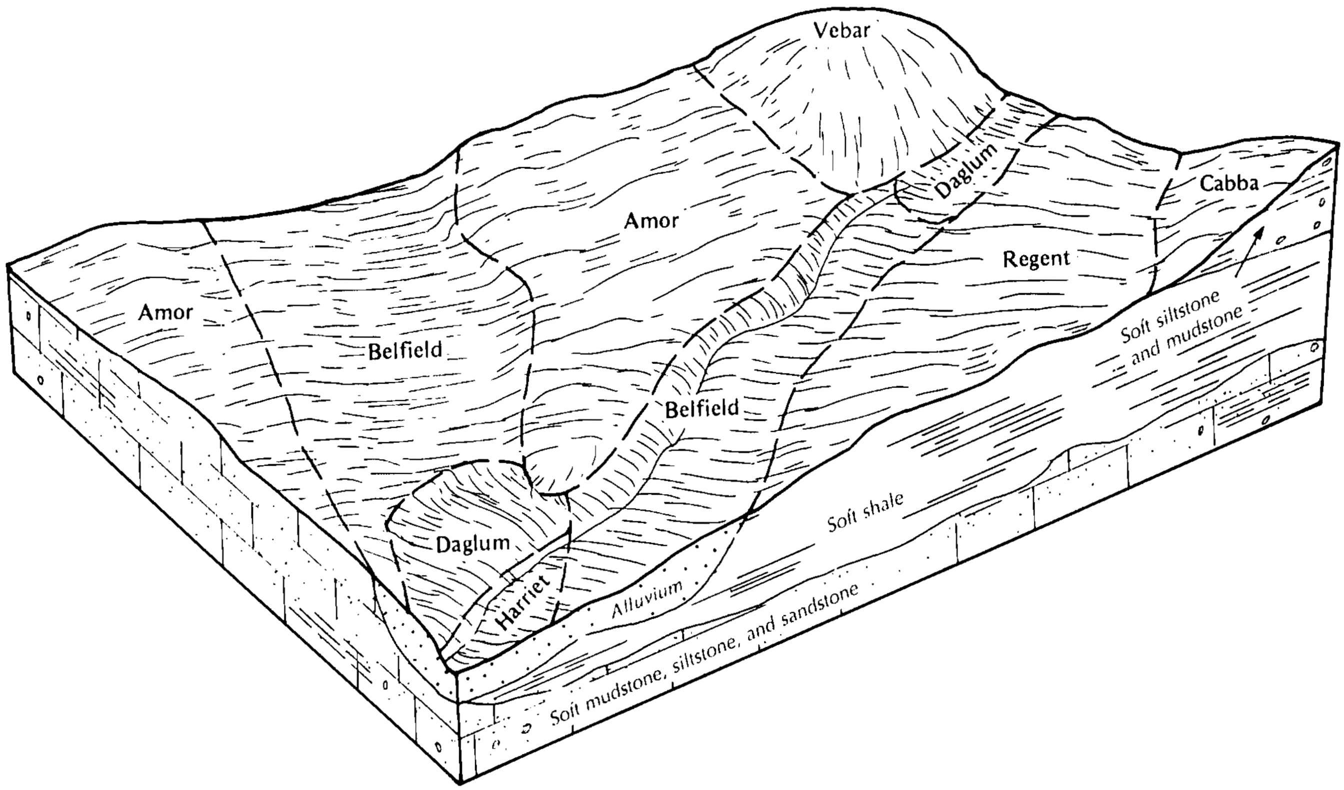

Figure 4.—Typical pattern of soils and underlying material in the Belfield-Amor-Regent association.

10. Daglum-Belfield-Amor Association

Deep and moderately deep, level to moderately sloping, well drained and moderately well drained, loamy soils

This association is on broad flats, foot slopes, and side slopes of uplands. Most areas are drained by shallow, intermittent streams. Slope ranges from 0 to 9 percent.

This association makes up about 2 percent of the county. It is about 26 percent Daglum and similar soils, 23 percent Belfield and similar soils, 16 percent Amor and similar soils, and 35 percent soils of minor extent (fig. 5).

The nearly level to moderately sloping, deep, well drained and moderately well drained, alkali Daglum soils are on foot slopes and broad flats. They are lower on the landscape than the Amor soils and occur as areas intermingled with areas of the Belfield soils. Typically, the surface layer is clay loam or loam about 7 inches thick. The subsoil is about 25 inches thick. It is clay in the upper part, silty clay in the next part, and silty clay loam in the lower part. The substratum to a depth of about 60 inches is silty clay loam.

The level to gently sloping, deep, well drained and moderately well drained, alkali Belfield soils are on foot slopes and broad flats. They are lower on the landscape than the Amor soils and occur as areas intermingled with areas of the Daglum soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches thick. The substratum to a depth of about 60 inches is clay loam.

The nearly level to moderately sloping, moderately deep, well drained Amor soils are on side slopes. They are higher on the landscape than the Belfield and Daglum soils. Typically, the surface layer is loam about 5 inches thick. The subsoil is loam about 18 inches thick. The substratum to a depth of about 30 inches is loam. Below this is soft mudstone.

Arnegard, Cabba, Harriet, Regent, and Vebar are the minor soils in this association. The nearly level Arnegard soils are deep and have a loam surface layer and subsoil. They are in swales. The moderately sloping to very steep Cabba soils are shallow. They are on hills and ridges. The level Harriet soils are poorly

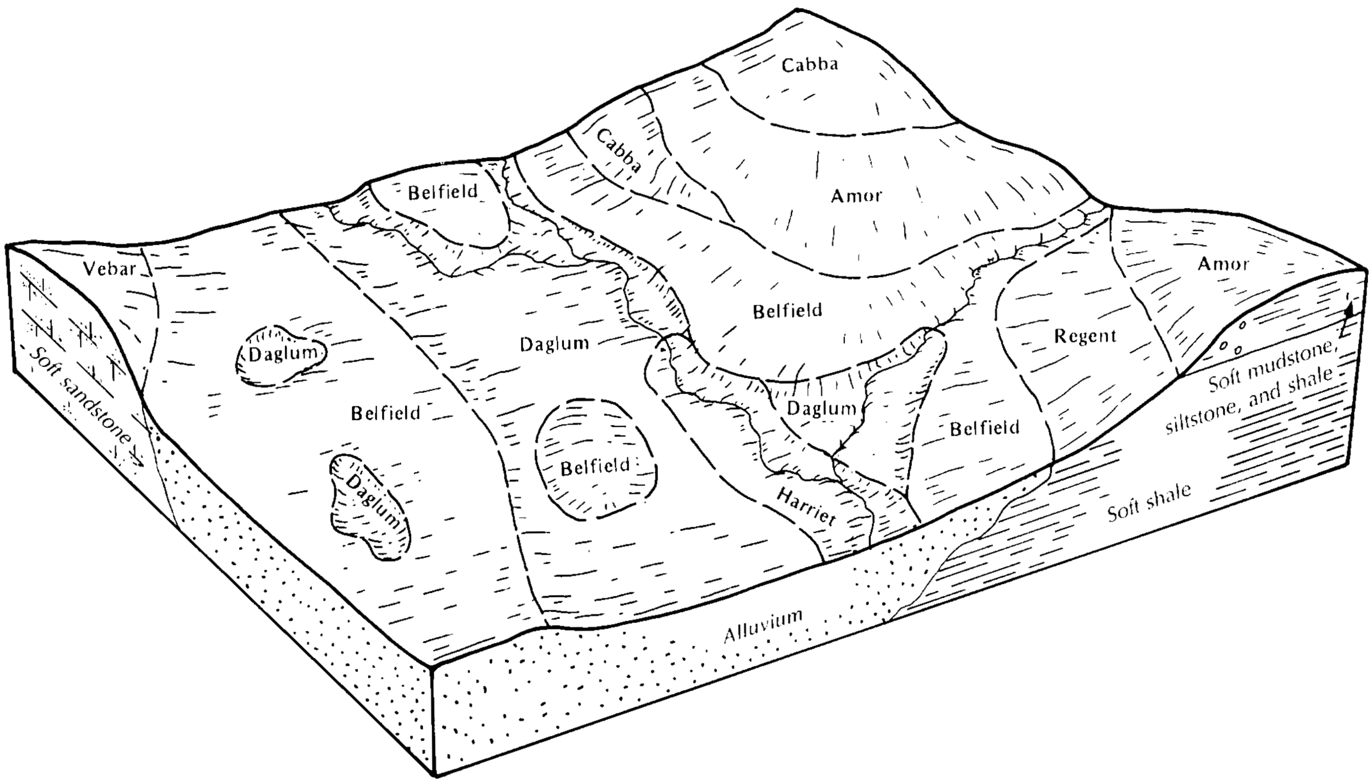

Figure 5.—Typical pattern of soils and underlying material in the Daglum-Belfield-Amor association.

drained. They are on narrow flood plains. The nearly level to moderately sloping Regent soils are moderately deep. They have a silty clay loam surface layer and subsoil. They are on side slopes. The nearly level to strongly sloping Vebar soils have a fine sandy loam surface layer and subsoil. They are on side slopes.

Most of this association is used for cultivated crops. The hazard of water erosion is moderate, and that of soil blowing is slight. The presence of sodium salts, limited rooting depth, and droughtiness are the main concerns for agricultural uses.

This association is well suited to range, is suited to hay and pasture, and is poorly suited to cultivated crops.

11. Regent-Belfield-Daglum Association

Moderately deep and deep, level to moderately sloping, well drained and moderately well drained, silty and loamy soils

This association is on broad flats, foot slopes, and side slopes of uplands. Most areas are drained by shallow, intermittent streams. Slope ranges from 0 to 9 percent.

This association makes up about 5 percent of the county. It is about 25 percent Regent and similar soils, 23 percent Belfield and similar soils, 22 percent Daglum and similar soils, and 30 percent soils of minor extent.

The nearly level to moderately sloping, moderately deep, well drained Regent soils are on side slopes. They are higher on the landscape than the Belfield and Daglum soils. Typically, the surface layer is silty clay loam about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. Below this is soft shale.

The level to gently sloping, deep, well drained and moderately well drained, alkali Belfield soils are on foot slopes and broad flats. They are lower on the landscape than the Regent soils and occur as areas intermingled with areas of the Daglum soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches thick. The substratum to a depth of about 60 inches is clay loam.

The nearly level to moderately sloping, deep, well drained and moderately well drained, alkali Daglum soils are on foot slopes and broad flats of uplands. They are lower on the landscape than the Regent soils

and occur as areas intermingled with areas of the Belfield soils. Typically, the surface layer is clay loam or loam about 7 inches thick. The subsoil is about 25 inches thick. It is clay in the upper part, silty clay in the next part, and silty clay loam in the lower part. The substratum to a depth of about 60 inches is silty clay loam.

Amor, Arnegard, Cabba, Harriet, and Vebar are the minor soils in this association. The nearly level to moderately sloping Amor soils are moderately deep and have a loam surface layer and subsoil. They are on upper and mid side slopes. The nearly level Arnegard soils are deep and have a loam surface layer and subsoil. They are in swales. The moderately sloping to very steep Cabba soils are shallow. They are on hills and ridges. The level Harriet soils are poorly drained. They are on narrow flood plains. The nearly level to moderately sloping Vebar soils are moderately deep. They have a fine sandy loam surface layer and subsoil. They are on side slopes.

Most of this association is used for cultivated crops. The hazard of water erosion is severe, and that of soil blowing is slight. The presence of sodium salts in the Belfield and Daglum soils, limited rooting depth, and droughtiness are the main concerns for agricultural uses.

This association is well suited to range, hay, and pasture and is suited to cultivated crops.

Deep, Loamy Soils on Flood Plains and Terraces

These soils formed in alluvium. They make up about 8 percent of the county. Most areas are used for range or cultivated crops. The soils are suited to these uses. The main concerns in managing range are achieving uniform distribution of grazing, developing nonsalty watering facilities, and maintaining an adequate cover of the important forage plants. The main concerns in managing cultivated areas are controlling soil blowing and controlling scouring during flooding.

12. Harriet-Daglum-Belfield Association

Deep, level to gently sloping, poorly drained, well drained, and moderately well drained, loamy soils

This association is on flood plains and terraces. Most areas are crossed by shallow, intermittent drainageways that are perpendicular to streams. Slope ranges from 0 to 6 percent.

This association makes up about 1 percent of the county. It is about 39 percent Harriet and similar soils, 20 percent Daglum and similar soils, 17 percent Belfield and similar soils, and 24 percent soils of minor extent (fig. 6).

The level, poorly drained, alkali, saline Harriet soils are on flood plains. They are lower on the landscape than the Belfield and Daglum soils. Typically, the surface layer is loam about 4 inches thick. The subsoil is clay about 36 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is mottled clay.

The nearly level and gently sloping, well drained and moderately well drained Daglum soils are on terraces. They are higher on the landscape than the Harriet soils and occur as areas intermingled with areas of the Belfield soils. Typically, the surface layer is clay loam or loam about 7 inches thick. The subsoil is about 25 inches thick. It is clay in the upper part, silty clay in the next part, and silty clay loam in the lower part. The substratum to a depth of about 60 inches is silty clay loam.

The level to gently sloping, well drained and moderately well drained Belfield soils are on terraces. They are higher on the landscape than the Harriet soils and occur as areas intermingled with areas of the Daglum soils. Typically, the surface layer is about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next layer is silty clay loam about 5 inches thick. The subsoil is silty clay about 41 inches thick. The substratum to a depth of about 60 inches is clay loam.

Amor, Cabba, Parshall, and Regent are the minor soils in this association. The nearly level to moderately sloping Amor and Regent soils are moderately deep. They are on side slopes. The moderately sloping to very steep Cabba soils are shallow. They are on ridges and hills. The nearly level and gently sloping Parshall soils have a fine sandy loam surface soil and subsoil. They are on terraces.

Most of this association is used for range. The presence of sodium salts, limited rooting depth, flooding, and wetness in the Harriet soil are the main concerns for agricultural uses.

This association is suited to range, hay, and pasture and is poorly suited to cultivated crops.

13. Korchea-Bowdle-Parshall Association

Deep, level to gently sloping, well drained, loamy soils

This association is on flood plains and terraces. Most areas are crossed by shallow, intermittent drainageways that are perpendicular to streams. Slope ranges from 0 to 6 percent.

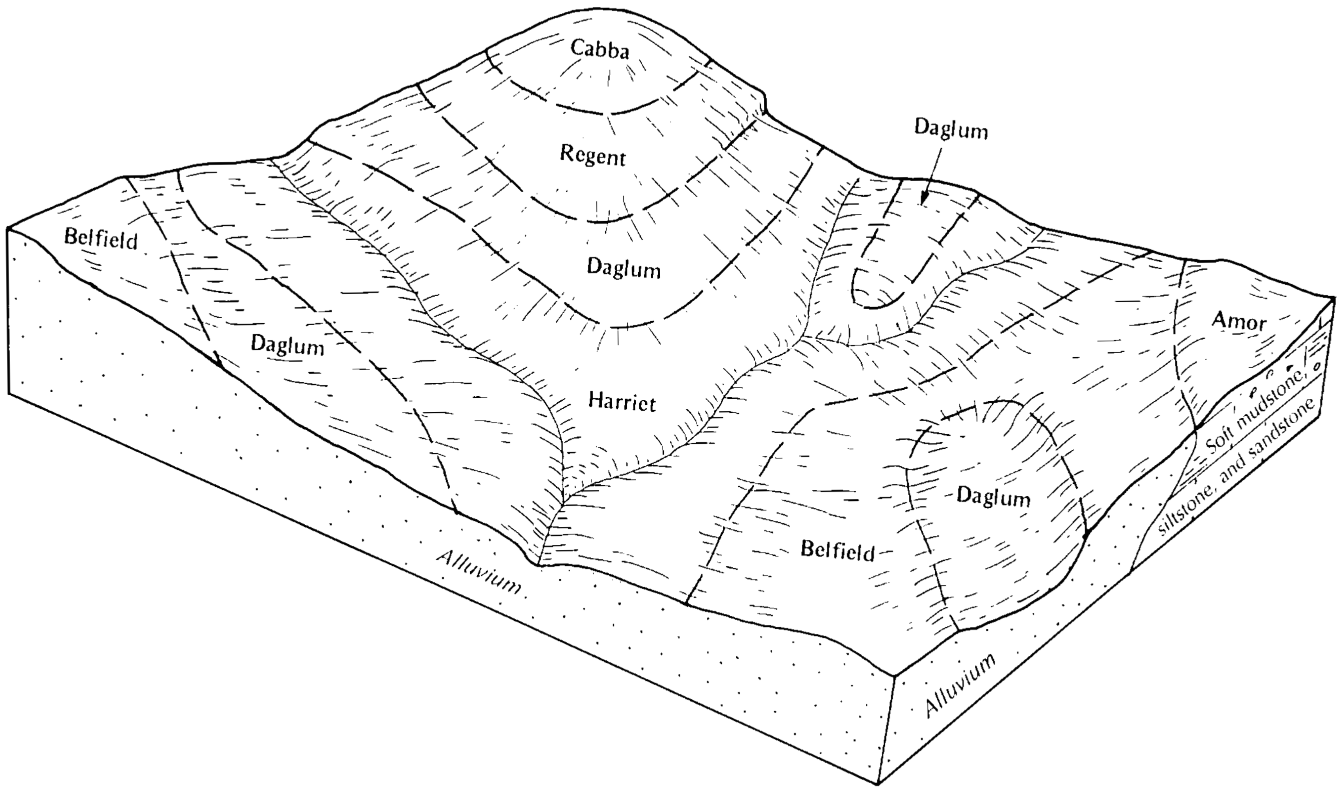

Figure 6.—Typical pattern of soils and underlying material in the Harriet-Daglum-Belfield association.

This association makes up about 7 percent of the county. It is about 29 percent Korchea and similar soils, 21 percent Bowdle and similar soils, 18 percent Parshall and similar soils, and 32 percent soils of minor extent (fig. 7).

The level and nearly level Korchea soils are on flood plains. Typically, the surface layer is loam about 8 inches thick. The substratum extends to a depth of about 60 inches. It is loam and silt loam in the upper part, loam in the next part, clay loam in the next part, and sandy loam in the lower part.

The level to gently sloping Bowdle soils are on terraces. Typically, the surface layer is loam about 6 inches thick. The subsoil is loam about 22 inches thick. The substratum to a depth of about 60 inches is very gravelly sand.

The nearly level and gently sloping Parshall soils are on terraces. Typically, the surface layer is fine sandy loam about 10 inches thick. The subsoil to a depth of about 60 inches is fine sandy loam.

Amor, Belfield, Cabba, Harriet, Lehr, and Vebar are the minor soils in this association. The nearly level to moderately sloping Amor soils are moderately deep. They are on side slopes. The nearly level and gently sloping Belfield soils have a dense, alkali subsoil. They are in swales. The strongly sloping to very steep Cabba soils are shallow. They are on escarpments and valley walls. The level Harriet soils are poorly drained. They are on flood plains. The nearly level to strongly sloping Lehr soils have a gravelly loamy sand substratum at a depth of about 15 inches. They are on escarpments and terraces. The nearly level to moderately sloping Vebar soils have a fine sandy loam surface layer and subsoil. They are on side slopes.

Most areas of this association are used for cultivated crops; however, some areas are used for hay, pasture, or range. Flooding and soil blowing are the main concerns for agricultural uses. Most areas have a sparse to dense stand of native trees and shrubs along the stream channels. These trees and shrubs provide food and cover for wildlife.

This association is well suited to cultivated crops, hay, pasture, and range.

Broad Land Use Considerations

The general soil map can be useful in planning future

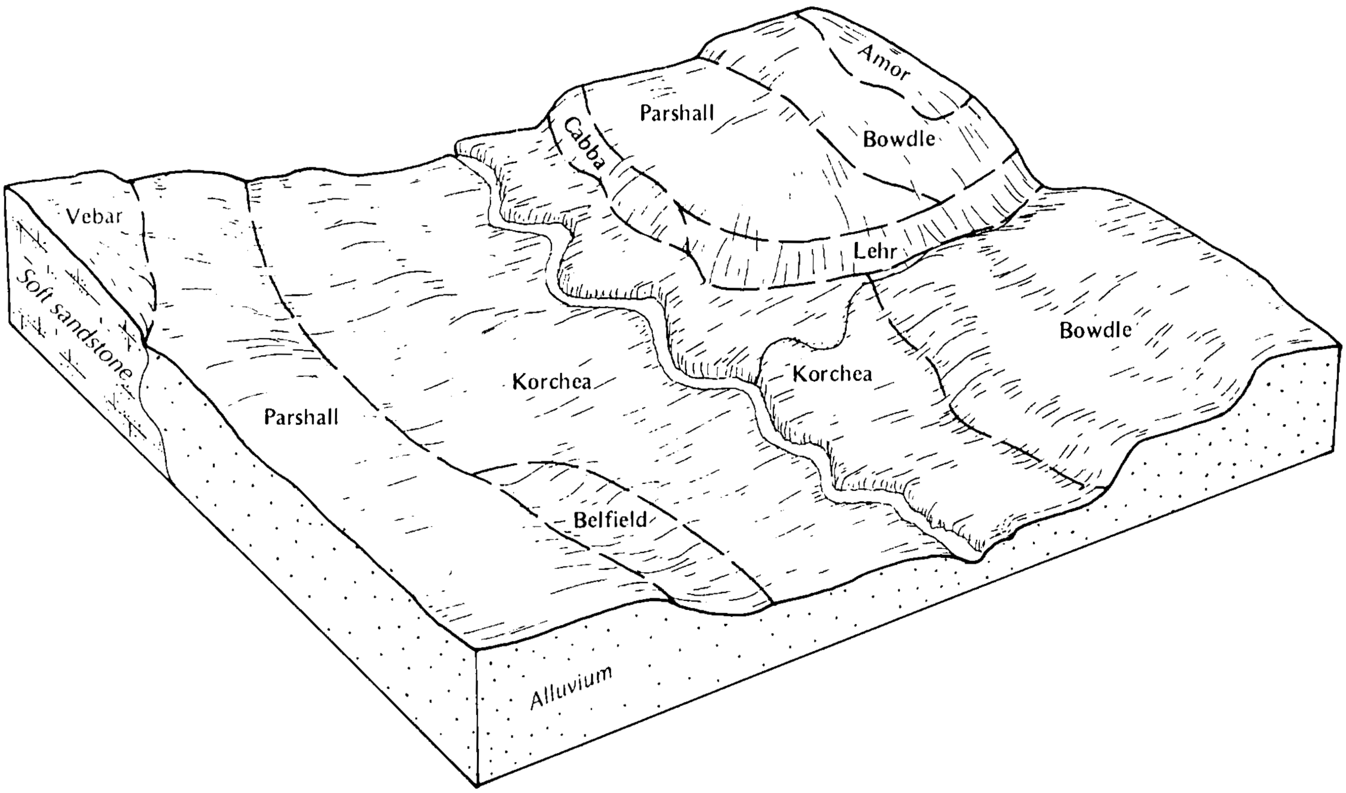

Figure 7.—Typical pattern of soils and underlying material in the Korchea-Bowdle-Parshall association.

land use patterns in Hettinger County.

The soils in Hettinger County differ widely in their potential for major land uses. Approximately 80 percent of the acreage in the county is used for cultivated crops or for tame pasture and hay. The main cultivated crops are spring wheat, barley, and sunflowers.

The periodic shortage of moisture common to the local climate is a major limitation for crops on all soils in the county. The hazard of soil blowing is severe in the Parshall-Vebar-Shambo and Vebar-Parshall-Flasher associations. The hazard of water erosion is severe in the Vebar-Parshall-Flasher, Belfield-Amor-Regent, Amor-Belfield-Cabba, Cabba-Savage-Amor, Felor-Amor-Cabba, Chama-Belfield-Cabba, Moreau-Lawther-Amor, and Regent-Belfield-Daglum associations.

Salinity and alkalinity are limitations for cultivated crops in the Daglum-Belfield-Amor, Regent-Belfield-Daglum, Harriet-Daglum-Belfield, and Dimmick-Belfield-Reeder associations. The Korchea-Bowdle-Parshall association is subject to periodic flooding.

The limited availability of suitable water restricts the potential for irrigation in this county. The Korchea-Bowdle-Parshall association has the greatest potential for irrigation.

Scattered areas of rangeland are throughout the county. Many of the soils are too steep or too shallow for cultivated crops or have an alkali-affected subsoil that limits their suitability for crops.

All of the soils in the county provide habitat for many important species of wildlife.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Parshall fine sandy loam, 1 to 6 percent slopes, is a phase of the Parshall series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Regent-Daglum complex, 3 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits-Dumps complex is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

2—Heil silty clay loam. This deep, level, poorly drained, alkali soil is in depressions on uplands. It is subject to ponding. Slopes are concave, short, and smooth. Individual areas are circular or irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is light gray, mottled silty clay loam about 3 inches thick. The subsoil is gray silty clay about 49 inches thick. It is mottled between depths of 3 and 12 inches. The substratum to a depth of about 60 inches is light gray silty clay. In some places the surface layer is thicker and darker and is silty clay or silt loam. In a few places the soil is calcareous at the surface and strongly saline.

Included with this soil in mapping are small areas of Arnegard, Daglum, and Rhoades soils. These soils make up about 10 to 20 percent of the unit. Arnegard soils are well drained, Daglum soils are moderately well drained and well drained, and Rhoades soils are well drained and moderately well drained. The included soils

are on the rim of the depressions.

Permeability is very slow in the Heil soil. Runoff is ponded. Available water capacity and the organic matter content are high. The salts in the soil limit the amount of water available to plants. A seasonal high water table is 1 foot above the surface to 1 foot below the surface. The dense, alkali subsoil restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for range, hay, or wetland wildlife habitat. Some areas are used for cultivated crops. This soil generally is unsuited to cultivated crops and to trees and shrubs because of salinity, alkalinity, and wetness. The soil is poorly suited to grasses and legumes. It is best suited to wetland wildlife habitat and range. The main concerns in managing wetland wildlife habitat are controlling siltation and maintaining the natural water level.

In areas where this soil is used as range, the important forage plant is western wheatgrass. Tall wheatgrass, western wheatgrass, and alsike clover are suitable hay and pasture plants. Compaction, trampling, and root shearing are problems, especially if the range is grazed when the soil is wet. These problems can be overcome by deferring grazing when the soil is wet. Stock water reservoir sites generally are available in areas of this soil; however, the reservoirs sometimes contain salty water.

This soil generally is unsuited to buildings and septic tank absorption fields because of ponding, the seasonal high water table, very slow permeability, and a high shrink-swell potential. Soils better suited to these uses generally are nearby.

The land capability classification is VIs. The range site is Closed Depression. The productivity index for spring wheat is 0.

3—Dimmick silty clay. This deep, level, very poorly drained soil is in depressions on uplands. It is subject to ponding. Slopes are concave, short, and smooth. Individual areas are circular or irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface soil is about 14 inches thick. It has a cover of partially decomposed leaves, twigs, and roots. It is gray, mottled silty clay in the upper part and gray, mottled clay in the lower part. The subsoil is gray clay about 17 inches thick. The substratum to a depth of about 60 inches is mottled clay. It is dark gray in the upper part and light gray in the lower part. In some places there is no cover of partially decomposed leaves, twigs, and roots on the surface. In other places, the surface soil is darker and the soil is calcareous throughout.

Included with this soil in mapping are small areas of Heil and Regan soils. These soils make up about 5 to 20 percent of the unit. They are poorly drained. The Heil soils have a dense, alkali subsoil and occur on the rim of the depressions. The Regan soils are highly calcareous. They occur as areas intermingled with areas of this Dimmick soil. Also included are some areas of saline soils.

Permeability is very slow in the Dimmick soil. Runoff is ponded. Available water capacity and the organic matter content are high. A seasonal high water table is 1 foot above the surface to 2 feet below the surface. Tilth is poor.

Most areas of this unit are used for range, hay, or wetland wildlife habitat. Some areas are used for cultivated crops. This soil is best suited to wetland wildlife habitat, range, and hay. The main concerns in managing wetland wildlife habitat are maintaining the natural water level and controlling siltation.

If drained, this soil is suited to small grain and sunflowers and to grasses and legumes. Drainage helps to control wetness; however, locating suitable drainage outlets generally is difficult. The hazard of soil blowing is moderate, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling wetness, improving tilth, and controlling soil blowing. Applying a system of conservation tillage that includes leaving crop residue on the surface helps to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer improve fertility and tilth and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are rivergrass, slough sedge, and prairie cordgrass. Creeping foxtail, big bluestem, and alsike clover are suitable hay and pasture plants. Compaction, trampling, and root shearing are problems, especially if the range or pasture is grazed when the soil is wet. These problems can be overcome by deferring grazing when the soil is wet. Stock water reservoir sites generally are available in areas of this soil.

If drained, this soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Undrained areas generally are unsuited to trees and shrubs. Wetness is a critical limitation affecting survival, growth, and vigor. Grasses and weeds on this soil are abundant and persistent. Eliminating this ground cover before the trees and shrubs are planted and then controlling its regrowth improve the survival and growth rates of the seedlings.

Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protects the seedlings from abrasion.

This soil generally is unsuited to buildings and septic tank absorption fields because of ponding, the seasonal high water table, very slow permeability, and a high shrink-swell potential. Soils better suited to these uses generally are nearby.

The land capability classification is IIIw. The range site is Wetland. The productivity index for spring wheat ranges from 40 to 70, depending on the degree of drainage.

4—Grail clay loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is in swales on uplands and terraces. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are concave, long, and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface soil is about 12 inches thick. It is dark grayish brown. It is clay loam in the upper part and silty clay loam in the lower part. The subsoil is about 29 inches thick. It is grayish brown silty clay in the upper part, light yellowish brown silty clay in the next part, and light yellowish brown silty clay loam in the lower part. The next layer is light yellowish brown clay loam. The substratum to a depth of about 60 inches is light brownish gray clay. In some places the dark color of the surface soil extends to a depth of only 7 inches or to as much as 16 inches. In other places the surface soil is silty clay loam throughout or is silty clay or loam. In a few places the subsoil is alkali affected.

Included with this soil in mapping are small areas of Daglum and Rhoades soils. These soils make up about 5 to 15 percent of the unit. They have a dense, alkali subsoil and are in microdepressions.

Permeability is slow in the Grail soil. Runoff also is slow. The soil receives runoff from adjacent soils. Available water capacity and the organic matter content are high. Tilth is fair.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are improving tilth and maintaining fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are big bluestem, western wheatgrass, and green needlegrass. Crested wheatgrass, green needlegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. No critical limitations affect the use of this soil for trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The land capability classification is IIc. The range site is Overflow. The productivity index for spring wheat is 92.

5C—Wayden silty clay, 2 to 9 percent slopes. This shallow, nearly level to moderately sloping, well drained soil is on knobs and ridges. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex, short, and smooth. Individual areas are irregular in shape and range from about 5 to 75 acres in size.

Typically, the surface layer is light brownish gray silty clay about 4 inches thick. The next layer is light gray silty clay about 8 inches thick. The substratum to a depth of about 16 inches is light gray clay. Below this is gray, soft shale. In some places soft shale is at a depth of 20 to 36 inches. In a few places the surface layer and substratum are loam or silt loam.

Included with this soil in mapping are small areas of Belfield, Daglum, Lawther, and Rhoades soils. These soils make up about 5 to 25 percent of the unit. They are deep and in swales. The Belfield, Daglum, and Rhoades soils have a dense, alkali subsoil.

Permeability is slow in the Wayden soil. Runoff is

rapid. Available water capacity is very low. The organic matter content is moderately low. The shale restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or range. Because of the shallow rooting depth and droughtiness, this soil generally is unsuited to small grain, sunflowers, grasses and legumes, and trees and shrubs. It is best suited to range. The hazard of soil blowing is moderate, and that of water erosion is severe.

In areas where this soil is used as range, the important forage plants are western wheatgrass and little bluestem. Soil blowing, droughtiness, and water erosion are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important plants at a height that traps snow helps to overcome droughtiness, prevent denuding, and control soil blowing and water erosion. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

This soil is poorly suited to buildings and generally is unsuited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is also a limitation in septic tank absorption fields. Using a mound system helps to overcome the limitation of slow permeability and prevent the pollution of ground water.

The land capability classification is VIs. The range site is Shallow Clay. The productivity index for spring wheat is 0.

6B—Vebar-Parshall fine sandy loams, 1 to 6 percent slopes. These nearly level and gently sloping, well drained soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. The moderately deep Vebar soil is on upper side slopes and low rises. It has convex, short, smooth slopes. The deep Parshall soil is on lower side slopes and foot slopes. It has concave, short, smooth slopes. Individual areas are irregular in shape and range from about 10 acres to more than 200 acres in size. They are about 40 to 60 percent Vebar soil and 30 to 40 percent Parshall soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Vebar soil has a brown fine sandy loam surface layer about 6 inches thick. The subsoil is fine sandy loam about 26 inches thick. It is pale brown in the upper part and light brownish gray in the lower part. Below this is light gray, soft sandstone. In some places the surface layer is lighter colored and calcareous. In a few places the surface layer and subsoil are loamy fine sand or loam. In other places the depth to sandstone is more than 40 inches.

Typically, the Parshall soil has a dark grayish brown fine sandy loam surface soil about 10 inches thick. The subsoil is fine sandy loam to a depth of about 60 inches. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. In some places the surface layer and subsoil are loam or loamy fine sand.

Included with these soils in mapping are small areas of Belfield, Cabba, and Flasher soils. These included soils make up about 5 to 15 percent of the unit. The Belfield soils have an alkali subsoil. They are in swales. The Cabba and Flasher soils are shallow. They are on knobs and ridges.

Permeability is moderately rapid in the Vebar and Parshall soils. Runoff is slow on both soils. Available water capacity is low in the Vebar soil and moderate in the Parshall soil. The organic matter content is moderate in the Vebar soil and high in the Parshall soil. Tilth is good in both soils. The sandstone in the Vebar soil restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, and minimizing summer fallow help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface or adding organic material into the plow layer helps to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the

important forage plants are needleandthread and prairie sandreed. Western wheatgrass, tall wheatgrass, and meadow bromegrass are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

The Parshall soil is suited to all and the Vebar soil to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Vebar soil is somewhat droughty, and the trees and shrubs growing on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is low. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

These soils are suited to buildings. The Parshall soil is well suited and the Vebar soil is poorly suited to septic tank absorption fields. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored. The effluent in septic tank absorption fields in the Vebar soil may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. Absorption fields should be installed in areas of the Parshall soil.

The land capability classification of both soils is IIIe. The range site of both soils is Sandy. The productivity index of the unit for spring wheat is 63.

7C—Vebar-Flasher fine sandy loams, 3 to 9 percent slopes. These gently sloping and moderately sloping soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. The moderately deep, well drained Vebar soil is on side slopes. It has convex, moderately long, smooth slopes. The shallow, somewhat excessively drained Flasher soil is on knobs and ridges. It has convex, short, smooth slopes. Individual areas are irregular in shape and range from about 10 to 300 acres in size. They are about 45 to 60 percent Vebar soil and 30 to 40 percent Flasher soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Vebar soil has a brown fine sandy loam surface layer about 6 inches thick. The subsoil is fine sandy loam about 26 inches thick. It is pale brown in the upper part and light brownish gray in the lower part. Below this is light gray, soft sandstone. In some places the surface layer is lighter colored and calcareous. In a few places the surface layer and subsoil are loamy fine sand or loam. In other places the depth to sandstone is more than 40 inches.

Typically, the Flasher soil has a grayish brown fine sandy loam surface layer about 6 inches thick. The next layer is light brownish gray loamy fine sand about 10 inches thick. Below this is light gray, soft sandstone. In some places the surface layer is loamy fine sand. In other places a layer of fine sandy loam or loam is below the surface layer. In a few places the surface layer has been eroded by soil blowing.

Included with these soils in mapping are small areas of Arnegard and Parshall soils in swales. These included soils make up about 10 to 25 percent of the unit. They are deep. Also included are some small areas of sandstone rock outcrop and a few areas of soils underlain by hard sandstone.

Permeability is moderately rapid in the Vebar soil and rapid in the Flasher soil. Runoff is medium on both soils. Available water capacity is low in the Vebar soil and very low in the Flasher soil. The organic matter content is moderate in the Vebar soil and low in the Flasher soil. Tilth is good. The sandstone restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are poorly suited to small grain and sunflowers and are suited to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling soil blowing and water erosion and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, minimizing summer fallow, and maintaining grassed waterways help to control soil blowing and water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture

available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are needleandthread, little bluestem, and prairie sandreed. Crested wheatgrass, prairie sandreed, and sweetclover are suitable pasture and hay plants. Soil blowing is a hazard, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

The Vebar soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Flasher soil generally is unsuited to trees and shrubs. The Vebar soil is somewhat droughty, and the trees and shrubs growing on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is low. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect the seedlings from abrasion.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification of the Vebar soil is IVe, and that of the Flasher soil is VIe. The range site of the Vebar soil is Sandy, and that of the Flasher soil is Shallow. The productivity index of the unit for spring wheat is 47.

7D—Vebar-Flasher complex, 9 to 20 percent slopes. These strongly sloping and moderately steep soils are on uplands. Most areas are crossed by moderately deep drainageways, but in places drainageways are shallow. The moderately deep, well drained Vebar soil is on side slopes. It has convex, moderately long, smooth slopes. The shallow, somewhat excessively drained Flasher soil is on knobs and ridges. It has convex, short, smooth slopes. Individual areas are irregular in shape and range from about 10 to more than 250 acres in size. They are about 45 to 65 percent Vebar soil and 30 to 50 percent Flasher soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Vebar soil has a brown fine sandy loam surface layer about 6 inches thick. The subsoil is fine sandy loam about 26 inches thick. It is pale brown in the upper part and light brownish gray in the lower part. Below this is light gray, soft sandstone. In some places the surface layer is lighter colored and calcareous. In a few places the surface layer and subsoil are loamy fine sand or loam. In other places the depth to sandstone is more than 40 inches.

Typically, the Flasher soil has a light brownish gray loamy fine sand surface layer about 4 inches thick. The next layer is light yellowish brown loamy fine sand about 11 inches thick. Below this is light gray, soft sandstone. In some places the soil is fine sandy loam or loam throughout. In other places the surface layer has been eroded by soil blowing.

Included with these soils in mapping are small areas of Belfield, Ekalaka, and Parshall soils in swales. These included soils make up about 5 to 15 percent of the unit. They are deep. Also included are a few areas of sandstone rock outcrop, stony soils, and soils that are underlain by hard sandstone.

Permeability is moderately rapid in the Vebar soil and rapid in the Flasher soil. Runoff is rapid on both soils. Available water capacity is low in the Vebar soil and very low in the Flasher soil. The organic matter content is moderate in the Vebar soil and low in the Flasher soil. The sandstone restricts the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas are used for cultivated crops, hay, or pasture. These soils generally are unsuited to small grain and sunflowers because of droughtiness and slope. They are suited to hay, pasture, and range. The hazards of soil blowing and water erosion are severe.

In areas where these soils are used as range, the important forage plants are needleandthread, little bluestem, prairie sandreed, and western wheatgrass. Crested wheatgrass, western wheatgrass, prairie sandreed, and sweetclover are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing and water erosion, and overcome droughtiness. Gullies can form

along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Vebar soil is suited to a few of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Flasher soil generally is unsuited to trees and shrubs. The Vebar soil is somewhat droughty, and the trees and shrubs growing on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is low. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

These soils are poorly suited to buildings and septic tank absorption fields. Slope is a limitation for buildings and septic tank absorption fields, but it can be overcome by designing buildings and absorption fields to conform to the natural slope of the land. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification of both soils is VIe. The range site of the Vebar soil is Sandy, and that of the Flasher soil is Shallow. The productivity index of the unit for spring wheat is 0.

8—Belfield-Daglum clay loams, 1 to 3 percent slopes. These deep, nearly level, well drained and moderately well drained, alkali soils are in swales and on broad flats on uplands and terraces. Most areas are crossed by shallow drainageways, but in places drainageways are indistinct. In areas of native grass, slopes generally are concave, moderately long, and smooth. The surface has a characteristic microrelief. The Belfield soil is on micromounds, and the Daglum soil is in microdepressions. This microrelief is destroyed by cultivation. Individual areas are irregular in shape and range from about 10 to 300 acres in size. They are about 50 to 60 percent Belfield soil and 35 to 45 percent Daglum soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Belfield soil has a grayish brown surface layer about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next 5 inches is grayish brown silty clay loam that has light brownish gray coatings. The subsoil is silty clay about 41 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam, loam, silty clay loam, or silty clay. In other places the surface layer and subsoil are calcareous. In a few places the soil is nonalkali.

Typically, the Daglum soil has a grayish brown clay loam surface layer about 7 inches thick. The subsoil is about 25 inches thick. In sequence downward, it is brown clay, grayish brown clay, grayish brown silty clay, and light brownish gray silty clay loam. The substratum to a depth of about 60 inches is silty clay loam. It is light olive gray in the upper part and light brownish gray and mottled in the lower part. In some places the surface layer is silt loam or loam. In other places the surface layer is lighter colored and is silty clay loam; it has been mixed with the subsoil by tillage. In a few places salts are at a depth of 10 to 15 inches.

Included with these soils in mapping are small areas of Grail and Regent soils. These included soils make up about 5 to 10 percent of the unit. The Grail soils are nonalkali. They occur as areas intermingled with areas of the Belfield and Daglum soils. The Regent soils are moderately deep. They are on rises.

Permeability is slow in the Belfield soil and very slow in the Daglum soil. Runoff is slow on both soils. Available water capacity is high in the Belfield soil and moderate in the Daglum soil. The organic matter content is high in the Belfield soil and moderate in the Daglum soil. The salts in the Daglum soil limit the amount of water available to plants. Tilth is fair. The dense, alkali subsoil in the Daglum soil restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazards of soil blowing and water erosion are slight. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are improving tilth, overcoming moisture stress, and maintaining fertility. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-

seeded small grain to take advantage of moisture available early in the season help to overcome moisture stress. Using tillage that loosens the alkali subsoil or growing deep-rooted crops, such as alfalfa and sweetclover, helps to improve root and water penetration. Applying a system of conservation tillage that includes leaving crop residue on the surface and minimizing summer fallow help to control localized soil erosion. Conservation tillage also provides food and cover for wildlife.

In areas where these soils are used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, slender wheatgrass, and sweetclover are suitable hay and pasture plants. The dense subsoil and salts in the Daglum soil are problems, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Daglum soil. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding and overcome droughtiness. Stock water reservoir sites generally are available in areas of these soils.

The Daglum soil is suited to only a few of the drought- and salt-tolerant species of trees and shrubs and the Belfield soil to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Individual trees and shrubs on these soils vary in height, density, and vigor. They are affected by the restricted root development in the dense, alkali subsoil.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The Belfield soil is better suited to septic tank absorption fields than the Daglum soil. Slow permeability of the Belfield soil is a limitation in absorption fields, but it can be overcome by enlarging the field. Using a mound system helps to overcome the limitation of very slow permeability in the Daglum soil.

The land capability classification of the Belfield soil is IIIs, and that of the Daglum soil is IVs. The range site of the Belfield soil is Clayey, and that of the Daglum soil is Claypan. The productivity index of the unit for spring wheat is 62.

8B—Belfield-Daglum clay loams, 3 to 6 percent slopes. These deep, gently sloping, well drained and moderately well drained, alkali soils are in swales and on flats on terraces and uplands. Most areas are crossed by shallow drainageways, but in places the drainageways are moderately deep. In areas of native grass, slopes generally are concave, moderately long, and smooth. The surface has a characteristic microrelief. The Belfield soil is on micromounds, and the Daglum soil is in microdepressions. This microrelief is destroyed by cultivation. Individual areas are irregular in shape and range from about 10 to 150 acres in size. They are about 55 to 65 percent Belfield soil and 25 to 35 percent Daglum soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Belfield soil has a grayish brown surface layer about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next 5 inches is grayish brown silty clay loam that has light brownish gray coatings. The subsoil is silty clay about 41 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam, loam, silty clay loam, or silty clay. In other places the soil is nonalkali. In a few places the surface layer and subsoil are calcareous.

Typically, the Daglum soil has a grayish brown clay loam surface layer about 7 inches thick. The subsoil is about 25 inches thick. In sequence downward, it is brown clay, grayish brown clay, grayish brown silty clay, and light brownish gray silty clay loam. The substratum to a depth of about 60 inches is silty clay loam. It is light olive gray in the upper part and light brownish gray and mottled in the lower part. In some places the surface layer is silt loam, fine sandy loam, or loam. In other places the surface layer is lighter colored and is silty clay loam; it has been mixed with the subsoil by tillage. In some areas salts are at a depth of 10 to 15 inches.

Included with these soils in mapping are small areas of Amor, Cabba, Regent, and Shambo soils. These included soils make up about 5 to 20 percent of the unit. The Amor and Regent soils are moderately deep. They are on side slopes. The Cabba soils are shallow. They are on knobs and ridges. The Shambo soils are nonalkali and have a loam surface layer and subsoil. They are on lower side slopes.

Permeability is slow in the Belfield soil and very slow in the Daglum soil. Runoff is medium on both soils.

Available water capacity is high in the Belfield soil and moderate in the Daglum soil. The organic matter content is high in the Belfield soil and moderate in the Daglum soil. The salts in the Daglum soil limit the amount of water available to plants. Tilth is fair. The dense, alkali subsoil in the Daglum soil restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are controlling water erosion, improving or maintaining tilth, and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness. Using tillage that loosens the alkali subsoil or growing deep-rooted crops, such as alfalfa and sweetclover, helps to improve root and water penetration.

In areas where these soils are used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, slender wheatgrass, and sweetclover are suitable hay and pasture plants. The dense subsoil and salts in the Daglum soil are problems, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Daglum soil. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control water erosion, and overcome droughtiness. Stock water reservoir sites generally are available in areas of these soils.

The Daglum soil is suited only to a few of the drought- and salt-tolerant species of trees and shrubs and the Belfield soil to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Individual trees and shrubs on these soils vary in height, density, and vigor. They are affected by the restricted root development in the dense, alkali subsoil.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The Belfield soil is better suited to septic tank absorption fields than the Daglum soil. Slow permeability of the Belfield soil is a limitation in absorption fields, but it can be overcome by enlarging the field. Using a mound system helps to overcome the limitation of very slow permeability in the Daglum soil.

The land capability classification of the Belfield soil is IIIe, and that of the Daglum soil is IVs. The range site of the Belfield soil is Clayey, and that of the Daglum soil is Claypan. The productivity index of the unit for spring wheat is 57.

9—Regent silty clay loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is on flats on uplands. Most areas are crossed by shallow drainageways, but in places the drainageways are moderately deep. Slopes are plane or convex and are long and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. It is grayish brown in the upper part, light brownish gray in the next part, and light brownish gray and light yellowish brown in the lower part. Below this is light yellowish brown, pale olive, and brownish yellow, soft shale. In some places the depth to soft shale is more than 40 inches. In other places, the surface layer is silt loam or loam and the subsoil is clay loam. In a few places the dark color of the surface layer extends to a depth of more than 16 inches. In some areas the surface layer is lighter colored, calcareous, and silty clay.

Included with this soil in mapping are small areas of Belfield, Daglum, and Grail soils. These soils make up about 5 to 20 percent of the unit. They are deep and in swales. The Belfield and Daglum soils have a dense, alkali subsoil.

Permeability is slow in the Regent soil. Runoff also is slow. Available water capacity is low. The organic matter content is moderate. Tilth is fair. The shale

restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are improving tilth and maintaining fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and green needlegrass. Crested wheatgrass, western wheatgrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation and prevent the pollution of ground water.

The land capability classification is IIc. The range site is Clayey. The productivity index for spring wheat is 85.

9B—Regent silty clay loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places the drainageways are moderately deep. Slopes are convex, long, and smooth. Individual areas are irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. It is grayish brown in the upper part, light brownish gray in the next part, and light brownish gray and light yellowish brown in the lower part. Below this is light yellowish brown, pale olive, and brownish yellow, soft shale. In some places the depth to shale is more than 40 inches. In other places, the surface layer is silt loam or loam and the subsoil is clay loam. In a few places the surface layer is lighter colored, calcareous, and silty clay.

Included with this soil in mapping are small areas of Cabba and Daglum soils. These soils make up about 5 to 15 percent of the unit. The Cabba soils are shallow. They are on knobs and ridges. The Daglum soils are deep and have a dense, alkali subsoil. They are in swales.

Permeability is slow in the Regent soil. Runoff is medium. Available water capacity is low. The organic matter content is moderate. Tilth is fair. The shale restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion and improving tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and green needlegrass. Crested wheatgrass, western wheatgrass, and alfalfa are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to

septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation and prevent the pollution of ground water.

The land capability classification is IIe. The range site is Clayey. The productivity index for spring wheat is 72.

9C—Regent-Cabba complex, 6 to 9 percent slopes. These moderately sloping, well drained soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. The moderately deep Regent soil is on side slopes. It has convex, long, smooth slopes. The shallow Cabba soil is on knobs and ridges. It has convex, short, smooth slopes. Individual areas are irregular in shape and range from about 5 to 100 acres in size. They are about 50 to 70 percent Regent soil and 25 to 40 percent Cabba soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Regent soil has a grayish brown silty clay loam surface layer about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. It is grayish brown in the upper part, light brownish gray in the next part, and light yellowish brown in the lower part. Below this is light yellowish brown and pale olive, soft shale. In some places the depth to shale is more than 40 inches. In other places, the surface layer is silt loam or loam and the subsoil is clay loam. In a few places the surface layer is calcareous and is silty clay or clay.

Typically, the Cabba soil has a grayish brown loam surface layer about 4 inches thick. The substratum is loam to a depth of about 13 inches. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft siltstone. In some places the surface layer and substratum are silt loam, silty clay loam, or silty clay. In a few places the surface layer is dark grayish brown.

Included with these soils in mapping are small areas of Belfield, Daglum, and Vebar soils. These included soils make up about 5 to 15 percent of the unit. The Belfield and Daglum soils are deep and have an alkali subsoil. They are in swales. The Vebar soils have a fine sandy loam surface layer and subsoil. They are on rises. Also included are small areas of shale outcrop and a few areas of soils underlain by hard shale.

Permeability is slow in the Regent soil and moderate in the Cabba soil. Runoff is rapid on both soils. Available water capacity is low in the Regent soil and very low in the Cabba soil. The organic matter content is moderate in the Regent soil and moderately low in the Cabba soil. Tilth in the Regent soil is fair, and that in the Cabba soil is good. The soft bedrock restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. These soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazard of soil blowing is slight for the Regent soil, and that for the Cabba soil is moderate. The hazard of water erosion is severe for both soils. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control soil blowing and water erosion. A conservation tillage system also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where these soils are used as range, the important forage plants are western wheatgrass, green needlegrass, needleandthread, and little bluestem. Crested wheatgrass, western wheatgrass, and sweetclover are suitable pasture and hay plants. Soil blowing and water erosion are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing and water erosion, and overcome droughtiness. Gullies can form along cattle trails. A planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Regent soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Cabba soil generally is unsuited to trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage

system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. The lower lying parts of the landscape, where the soils tend to be deeper, are better sites for waste disposal.

The land capability classification of the Regent soil is IIIe, and that of the Cabba soil is VIe. The range site of the Regent soil is Clayey, and that of the Cabba soil is Shallow. The productivity index of the unit for spring wheat is 43.

10B—Beisigl-Lihen loamy fine sands, 1 to 6 percent slopes. These nearly level and gently sloping soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are indistinct. The moderately deep, somewhat excessively drained Beisigl soil is on upper side slopes, low rises, and knobs. It has convex, short, smooth slopes. The deep, well drained Lihen soil is on lower side slopes and foot slopes. It has concave, short, smooth slopes. Individual areas are irregular in shape and range from about 10 to 150 acres in size. They are about 45 to 60 percent Beisigl soil and 35 to 55 percent Lihen soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Beisigl soil has a grayish brown loamy fine sand surface layer about 2 inches thick. The subsoil is loamy fine sand about 22 inches thick. It is pale brown in the upper part and light yellowish brown in the lower part. Below this is pale yellow, brownish yellow, and light yellowish brown, soft sandstone. The soil is calcareous throughout. In some places the surface layer and subsoil are fine sandy loam. In a few places soft sandstone is at a depth of more than 40 inches. In other places the soil is noncalcareous.

Typically, the Lihen soil has a dark grayish brown loamy fine sand surface soil about 15 inches thick. The next layer is grayish brown, calcareous loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous loamy fine sand. In some places the surface soil is calcareous. In other places the soil is noncalcareous to a depth of more than 40 inches. In a few places the surface soil and subsoil are fine sandy loam.

Included with these soils are small areas of Arnegard, Cabba, and Flasher soils. These included soils make up about 1 to 10 percent of the unit. The Arnegard soils are deep and are loam throughout. They are in swales. The Cabba and Flasher soils are shallow. They are on knobs and ridges.

Permeability is rapid in the Beisigl and Lihen soils. Runoff is slow on both soils. Available water capacity is very low in the Beisigl soil and low in the Lihen soil. The organic matter content is moderately low in both soils. Tilth is good. The sandstone in the Beisigl soil restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops, hay, or pasture. Some areas are used as range. The soils are poorly suited to small grain and sunflowers and are suited to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, minimizing summer fallow, and including grasses and legumes in the rotation help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface or adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are needleandthread and prairie sandreed. Intermediate and pubescent wheatgrass, prairie sandreed, and sweetclover are suitable pasture and hay plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

The Beisigl soil is suited to a few and the Lihen soil to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. These soils are droughty, and the trees and shrubs on them commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because available water capacity is very low or low. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the

rows of trees and shrubs helps to control soil blowing and protect the seedlings from abrasion.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored. The soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in pollution of ground water. The effluent in septic tank absorption fields in the Beisigl soil may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification of both soils is IVe. The range site of both soils is Sands. The productivity index of the unit for spring wheat is 41.

11—Moreau silty clay, 1 to 3 percent slopes. This moderately deep, nearly level, well drained and moderately well drained soil is on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are plane or convex and are moderately long and smooth. Individual areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is grayish brown silty clay about 4 inches thick. The subsoil is about 31 inches thick. It is light brownish gray silty clay in the upper part, pale olive silty clay in the next part, and light olive gray and pale olive channery silty clay in the lower part. Below this is light olive gray and gray, soft shale. In some places the surface layer is dark grayish brown. In other places the surface layer is calcareous. In some areas the surface layer is silty clay loam. In a few areas the depth to soft shale is more than 40 inches.

Included with this soil in mapping are small areas of Cabba, Daglum, and Wayden soils. These soils make up about 5 to 30 percent of the unit. Cabba and Wayden soils are shallow. They are on knobs and ridges. Daglum soils are deep. They are in swales.

Permeability is slow in the Moreau soil. Runoff also is slow. Available water capacity is low. The organic matter content is moderate. Tilth is poor. The shale restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is moderate, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and improving tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, and stripcropping help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Crested wheatgrass, slender wheatgrass, and alfalfa are suitable hay and pasture plants. Soil blowing is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control soil blowing. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation and prevent the pollution of ground water.

The land capability classification is IIIs. The range site is Clayey. The productivity index for spring wheat is 63.

11B—Moreau silty clay, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained and moderately well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex, moderately long, and smooth. Individual areas are irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is grayish brown silty clay about 4 inches thick. The subsoil is about 31 inches thick. It is light brownish gray silty clay in the upper part, pale olive silty clay in the next part, and light olive

gray and pale olive channery silty clay in the lower part. Below this is light olive gray and gray, soft shale. In some places the surface layer is dark grayish brown. In other places the surface layer is calcareous. In some areas the surface layer is silty clay loam. In a few areas the depth to soft shale is more than 40 inches.

Included with this soil in mapping are small areas of Cabba, Daglum, Savage, and Wayden soils. These soils make up about 10 to 25 percent of the unit. The Cabba and Wayden soils are shallow. They are on knobs and ridges. The Daglum and Savage soils are deep. They are in swales.

Permeability is slow in the Moreau soil. Runoff is medium. Available water capacity is low. The organic matter content is moderate. Tilth is poor. The shale restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are moderate. The main concerns in managing cultivated areas are controlling soil blowing and water erosion and improving tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control soil blowing and water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Crested wheatgrass, slender wheatgrass, and alfalfa are suitable hay and pasture plants. Soil blowing and water erosion are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants helps to control soil blowing and water erosion. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation and prevent the pollution of ground water.

The land capability classification is IIIe. The range site is Clayey. The productivity index for spring wheat is 52.

12B—Daglum-Rhoades loams, 1 to 6 percent slopes. These deep, nearly level and gently sloping, well drained and moderately well drained soils are on terraces and uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. In areas of native grass, slopes generally are convex or plane and are long and uneven. The surface has a characteristic microrelief. The alkali Daglum soil is on micromounds, and the alkali, saline Rhoades soil is in microdepressions. This microrelief is destroyed by cultivation. Barren scab spots also are characteristic of areas of these soils. Individual areas are irregular in shape and range from about 10 to 200 acres in size. They are about 40 to 65 percent Daglum soil and 35 to 60 percent Rhoades soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Daglum soil has a dark grayish brown loam surface layer about 5 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is clay about 21 inches thick. It is brown in the upper part, light gray in the next part, and pale olive in the lower part. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam. In some places the surface layer is silt loam, silty clay loam, silty clay, or clay loam. In other places the surface layer and subsoil are calcareous. In a few places the surface is stony. In some areas soft siltstone or shale is at a depth of 40 to 60 inches.

Typically, the Rhoades soil has a grayish brown loam surface layer about 2 inches thick. The subsoil is about 52 inches thick. In sequence downward, it is grayish brown clay, light yellowish brown clay loam, pale yellow silty clay, and light gray silty clay. Below this is light gray, soft shale. In some places the surface layer is clay loam, silty clay loam, or silty clay. In other places

the soft shale is at a depth of more than 60 inches.

Included with these soils in mapping are small areas of Belfield, Ekalaka, Harriet, and Moreau soils. These included soils make up about 5 to 15 percent of the unit. The Belfield soils do not have columnar structure in the upper part of the subsoil. They occur as areas intermingled with areas of the Daglum and Rhoades soils. The Ekalaka soils are fine sandy loam throughout. They are on slight rises. The Harriet soils are poorly drained. They are in drainageways. The Moreau soils are moderately deep. They are on slight rises. Also included are a few areas of stony soils.

Permeability is very slow in the Daglum and Rhoades soils. Runoff is medium on both soils. Available water capacity and the organic matter content are moderate in both soils. The salts in both soils limit the amount of water available to plants. Tilth is poor. The dense, alkali subsoil in both soils restricts the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas are used for cultivated crops, hay, or pasture. The soils are poorly suited to small grain and sunflowers and to grasses and legumes because of the dense, alkali subsoil. They are best suited to range. The hazard of soil blowing is slight, and that of water erosion is moderate. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are overcoming droughtiness and controlling water erosion. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome moisture stress. Using tillage that loosens the dense, alkali subsoil or growing deep-rooted crops, such as alfalfa and sweetclover, helps to improve root and water penetration. An onsite investigation should be made before deep tillage is undertaken. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, maintaining grassed waterways, and constructing terraces help to control water erosion.

In areas where these soils are used as range, the important forage plants are western wheatgrass and blue grama. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. The dense subsoil, droughtiness, and salts in the soils are concerns, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control water erosion, and overcome droughtiness. Stock water reservoirs constructed in areas of these soils sometimes contain salty water.

The Daglum soil is suited to only a few of the drought- and salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Rhoades soil generally is unsuited to trees and shrubs. Supplemental watering and irrigation improve the survival and growth rates of the seedlings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover also improve the survival and growth rates. Individual trees and shrubs on these soils vary in height, density, and vigor. They are affected by the restricted root development in the dense, alkali subsoil and the limited amount of water available to plants because of the salts in the soils.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Septic tank absorption fields are limited by the very slow permeability of the soils. Using a mound system helps to overcome this limitation.

The land capability classification of the Daglum soil is IVs, and that of the Rhoades soil is VIs. The range site of the Daglum soil is Claypan, and that of the Rhoades soil is Thin Claypan. The productivity index of the unit for spring wheat is 32.

13—Lawther silty clay, 1 to 3 percent slopes. This deep, nearly level, well drained soil is in swales and on flats on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are concave, moderately long, and smooth. Individual areas are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface layer is grayish brown, calcareous silty clay about 8 inches thick. The subsoil is about 34 inches thick. It is light brownish gray, calcareous clay in the upper part and light brownish gray, calcareous silty clay in the lower part. The substratum to a depth of about 60 inches is pale olive silty clay. In some places the surface layer is clay or silty clay loam. In other places, the surface layer is clay

loam and the surface layer and upper part of the subsoil are noncalcareous.

Included with this soil in mapping are small areas of Cabba, Daglum, and Moreau soils. These soils make up about 10 to 25 percent of the unit. The Cabba soils are shallow. They are on knobs. The Daglum soils have a dense, alkali subsoil. They are in microdepressions. The Moreau soils are moderately deep. They are on slight rises.

Permeability is slow in the Lawther soil. Runoff also is slow. Available water capacity and the organic matter content are high. Tilth is poor.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is moderate, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing, improving tilth, and maintaining fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control soil blowing and water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and green needlegrass. Crested wheatgrass, green needlegrass, and alfalfa are suitable hay and pasture plants. Soil blowing is a hazard, especially if the range is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control soil blowing. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification is IIs. The range site is Clayey. The productivity index for spring wheat is 77.

14B—Parshall fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is in swales on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are concave, moderately long, and smooth. Individual areas are irregular or linear in shape and range from about 10 to 200 acres in size.

Typically, the surface soil is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is fine sandy loam to a depth of about 60 inches. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. In some places the dark color of the surface soil extends to a depth of only 7 inches or to as much as 16 inches. In other places the lower part of the substratum is gravelly. In a few places the surface layer and subsoil are loam or loamy fine sand.

Included with this soil in mapping are small areas of Amor, Belfield, and Vebar soils. These soils make up about 5 to 15 percent of the unit. The Amor and Vebar soils are moderately deep. They are on side slopes or slight rises. The Belfield soils have an alkali subsoil. They are in microdepressions or along drainageways.

Permeability is moderately rapid in the Parshall soil. Runoff is slow. This soil receives runoff from adjacent soils. Available water capacity and the organic matter content are high. Tilth is good.

Most areas of this soil are used for cultivated crops. The soil is suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concern in managing cultivated areas is controlling soil blowing. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, and minimizing summer fallow help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are prairie sandreed and needleandthread. Crested wheatgrass, prairie sandreed, and sweetclover are suitable hay and pasture plants.

Soil blowing is a hazard, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants helps to prevent denuding and control soil blowing.

This Parshall soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is well suited to buildings and septic tank absorption fields.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 78.

15—Arnegard loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is in swales on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are indistinct. Slopes are concave, moderately long, and smooth. Individual areas are linear or irregular in shape and range from about 5 to 50 acres in size.

Typically, the surface soil is dark grayish brown loam about 13 inches thick. The subsoil to a depth of about 60 inches is loam. It is grayish brown in the upper part and light brownish gray in the lower part. In some places the dark color of the surface layer extends to a depth of only 8 inches or to as much as 16 inches. In a few places the surface layer is fine sandy loam or silt loam. In other places the subsoil has an accumulation of clay. In some areas the subsoil is underlain by clayey sediment or by sand and gravel.

Included with this soil in mapping are small areas of Belfield, Reeder, and Vebar soils. These soils make up about 5 to 15 percent of the unit. The Belfield soils have an alkali subsoil. They are in swales. The Reeder and Vebar soils are moderately deep. They are on slight rises and side slopes.

Permeability is moderate in the Arnegard soil. Runoff is slow. This soil receives runoff from adjacent soils. Available water capacity and the organic matter content are high. Tilth is good.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concern in managing cultivated areas is maintaining tilth and fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are big bluestem, green needlegrass, and western wheatgrass. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. No critical limitations affect the use of this soil for trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The moderately slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The land capability classification is IIc. The range site is Overflow. The productivity index for spring wheat is 94.

16—Shambo loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on flats on terraces and uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are plane, long, and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 39 inches thick. In sequence downward, it is grayish brown loam, light olive brown loam, light yellowish brown loam, and pale yellow clay loam. The substratum to a depth of about 60 inches is pale yellow clay loam. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In other places the surface layer and subsoil are fine sandy loam or clay loam. In a few places the soil is calcareous throughout.

In a few areas soft bedrock or gravel is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Chama and Parshall soils. These soils make up about 10 to 25 percent of the unit. The Chama soils are moderately deep. They are on slight rises and side slopes. The Parshall soils have a fine sandy loam subsoil. They are in swales. Also included are a few areas of soils that are gently sloping.

Permeability is moderate in the Shambo soil. Runoff is slow. Available water capacity and the organic matter content are high. Tilth is good.

Most areas are used for cultivated crops. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concern in managing cultivated areas is maintaining tilth and fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The land capability classification is IIc. The range site is Silty. The productivity index for spring wheat is 84.

16B—Shambo loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on rises on terraces and uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are plane, moderately long, and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 39 inches thick. In sequence downward, it is grayish brown loam, light olive brown loam, light yellowish brown loam, and pale yellow clay loam. The substratum to a depth of about 60 inches is pale yellow clay loam. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In other places the surface layer and subsoil are fine sandy loam or clay loam. In a few places the soil is calcareous throughout. In a few areas soft bedrock or gravel is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Daglum, Parshall, and Vebar soils. These soils make up about 1 to 15 percent of the unit. The Daglum soils have a dense, alkali subsoil. They are in microdepressions. The Parshall soils have a fine sandy loam subsoil. They are in swales. The Vebar soils are moderately deep. They are on slight rises and side slopes.

Permeability is moderate in the Shambo soil. Runoff is medium. Available water capacity and the organic matter content are high. Tilth is good.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling erosion and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 78.

17—Chama silt loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is on flats on uplands. Most areas are crossed by shallow drainageways. Slopes are convex or plane and are moderately long and smooth. Individual areas are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 6 inches thick. The subsoil is about 25 inches thick. It is light grayish brown, calcareous silt loam in the upper part and light yellowish brown silty clay loam in the lower part. Below this is pale yellow and gray, soft siltstone. In some places the upper part of the subsoil is noncalcareous. In other places the surface layer is loam or silty clay loam. In a few places the subsoil is loam. In a few areas soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Arnegard, Belfield, and Cabba soils. These soils make up about 15 to 35 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Cabba soils are shallow. They are on knobs and ridges.

Permeability is moderate in the Chama soil. Runoff is slow. Available water capacity and the organic matter content are moderate. Tilth is good. The siltstone restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is moderate, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control soil blowing and water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, western wheatgrass, and alfalfa are suitable hay and pasture plants. Soil blowing is a hazard, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants helps to prevent denuding and control soil blowing.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 73.

17B—Chama silt loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes commonly are convex, moderately long, and smooth, but in places they are short. Individual areas are irregular in shape and range from about 10 to 400 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 6 inches thick. The subsoil is about 25 inches thick. It is light grayish brown, calcareous silt loam in the upper part and light yellowish brown silty clay loam in the lower part. Below this is

pale olive and gray, soft siltstone. In some places the upper part of the subsoil is noncalcareous. In other places the surface layer is loam or silty clay loam. In a few places the subsoil is loam. In a few areas soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Arnegard, Belfield, Cabba, and Regent soils. These soils make up about 10 to 25 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Cabba soils are shallow. They are on knobs and ridges. The Regent soils have a silty clay loam surface layer and subsoil. They occur as areas intermingled with areas of the Chama soil.

Permeability is moderate in the Chama soil. Runoff is medium. Available water capacity and the organic matter content are moderate. Tilth is good. The siltstone may restrict the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are moderate. The main concern in managing cultivated areas is controlling soil blowing and water erosion. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control soil blowing and water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. Water erosion and soil blowing are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants helps to prevent denuding and control soil blowing and water erosion.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 65.

17C—Chama-Cabba silt loams, 6 to 9 percent slopes. These moderately sloping, well drained soils are on uplands. Most areas are crossed by moderately deep drainageways. The moderately deep Chama soil is on side slopes. It has convex, moderately long, and smooth slopes. The shallow Cabba soil is on knobs and ridges. It has convex, short, and smooth slopes. Individual areas are irregular in shape and range from about 5 to 100 acres in size. They are about 55 to 75 percent Chama soil and 20 to 40 percent Cabba soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Chama soil has a dark grayish brown, calcareous silt loam surface layer about 6 inches thick. The subsoil is about 25 inches thick. It is light grayish brown, calcareous silt loam in the upper part and light yellowish brown silty clay loam in the lower part. Below this is pale olive and gray, soft siltstone. In some places the surface layer and the upper part of the subsoil are noncalcareous. In other places the surface layer is loam or silty clay loam. In a few places the subsoil is loam. In some areas soft bedrock is at a depth of 40 to 60 inches.

Typically, the Cabba soil has a grayish brown silt loam surface layer about 4 inches thick. The substratum to a depth of about 13 inches is loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft siltstone. In some places the surface layer and substratum are fine sandy loam, silt loam, or silty clay loam.

Included with these soils in mapping are small areas of Arnegard, Belfield, Moreau, and Vebar soils. These included soils make up about 5 to 20 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Moreau and Vebar soils are on side

slopes. The Moreau soils have a silty clay surface layer, and the Vebar soils have a fine sandy loam surface layer. Also included are some small areas of rock outcrop and a few areas underlain by hard bedrock.

Permeability is moderate in the Chama and Cabba soils. Runoff is rapid on both soils. Available water capacity is moderate in the Chama soil and very low in the Cabba soil. The organic matter content is moderate in the Chama soil and moderately low in the Cabba soil. The siltstone restricts the depth to which plant roots can penetrate. Tilth is good.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are poorly suited to small grain and sunflowers and are suited to grasses and legumes. The hazard of soil blowing is moderate, and that of water erosion is severe. The main concerns in managing cultivated areas are controlling erosion and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, using contour stripcropping, maintaining grassed waterways, and constructing terraces help to control water erosion and soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are western wheatgrass, needleandthread, blue grama, and little bluestem. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. Soil blowing, droughtiness, and water erosion are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing and water erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Chama soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Cabba soil generally is unsuited to trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect the seedlings from abrasion.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. The lower lying areas of the landscape, where the soils tend to be deeper, are better suited as sites for waste disposal.

The land capability classification of the Chama soil is IIIe, and that of the Cabba soil is VIe. The range site of the Chama soil is Silty, and that of the Cabba soil is Shallow. The productivity index of the unit for spring wheat is 45.

18—Amor loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is on flats on uplands. Most areas are crossed by shallow drainageways. Slopes are convex or plane and are moderately long and smooth. Individual areas are irregular in shape and range from about 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is loam about 18 inches thick. It is brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 30 inches is light brownish gray loam. Below this is light brownish gray, soft mudstone. In some places the surface layer and subsoil are fine sandy loam or silt loam. In other places the subsoil is clay loam or silty clay loam. In a few places soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Arnegard, Belfield, and Cabba soils. These soils make up about 5 to 25 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Cabba soils are shallow. They are on knobs and ridges.

Permeability is moderate in the Amor soil. Runoff is slow. Available water capacity is low. The organic matter content is high. Tilth is good. The mudstone restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and

to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are maintaining tilth and fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized soil erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, western wheatgrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIc. The range site is Silty. The productivity index for spring wheat is 78.

18B—Amor loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex, moderately long, and smooth. Individual areas are irregular in shape and range from about 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is loam about 18 inches thick. It is brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 30 inches is light brownish gray loam. Below this is light brownish gray, soft mudstone. In some places the surface layer and subsoil are fine sandy loam or silt loam. In other places the subsoil is clay loam or silty clay loam. In a few places soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Arnegard, Belfield, and Cabba soils. These soils make up about 10 to 25 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Cabba soils are shallow. They are on knobs and ridges.

Permeability is moderate in the Amor soil. Runoff is medium. Available water capacity is low. The organic matter content is high. Tilth is good. The mudstone restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling erosion and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants helps to prevent denuding and control water erosion.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound

system helps to prevent this pollution.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 73.

18C—Amor-Cabba loams, 6 to 9 percent slopes. These moderately sloping, well drained soils are on uplands. Most areas are crossed by moderately deep drainageways, but in places drainageways are shallow. The moderately deep Amor soil is on side slopes. It has convex, long, smooth slopes. The shallow Cabba soil is on knobs and ridges. It has convex, short, smooth slopes. Individual areas are irregular in shape and range from about 10 to 150 acres in size. They are about 40 to 60 percent Amor soil and 30 to 50 percent Cabba soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Amor soil has a dark grayish brown loam surface layer about 5 inches thick. The subsoil is loam about 18 inches thick. It is brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 30 inches is light brownish gray loam. Below this is light brownish gray, soft mudstone. In some places the surface layer and subsoil are fine sandy loam or silt loam. In a few places the subsoil is clay loam or silty clay loam. In other places soft bedrock is at a depth of 40 to 60 inches.

Typically, the Cabba soil has a grayish brown loam surface layer about 4 inches thick. The substratum to a depth of about 13 inches is loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft mudstone. In some places the surface layer and substratum are fine sandy loam, loamy fine sand, silt loam, or silty clay loam.

Included with these soils in mapping are small areas of Arnegard and Belfield soils in swales. These included soils make up about 10 to 25 percent of the unit. They are deep. Also included are some small areas of rock outcrop and a few areas underlain by hard bedrock.

Permeability is moderate in the Amor and Cabba soils. Runoff is rapid on both soils. Available water capacity is low in the Amor soil and very low in the Cabba soil. The organic matter content is high in the Amor soil and moderately low in the Cabba soil. Tilth is good. The soft bedrock restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is moderate, and that of water erosion is severe. The main concerns in managing cultivated areas are controlling soil blowing and water erosion and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, using contour stripcropping, maintaining grassed waterways, and constructing terraces help to control water erosion and soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface or adding organic material into the plow layer helps to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are needleandthread, western wheatgrass, and little bluestem. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. Soil blowing, droughtiness, and water erosion are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing and water erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Amor soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Cabba soil generally is unsuited to trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. The lower lying areas of the landscape, where the soils tend to be deeper, are better suited as sites for waste disposal.

The land capability classification of the Amor soil is IIIe, and that of the Cabba soil is VIe. The range site of the Amor soil is Silty, and that of the Cabba soil is

Shallow. The productivity index of the unit for spring wheat is 47.

18D—Amor-Cabba loams, 9 to 15 percent slopes. These strongly sloping, well drained soils are on uplands. Most areas are crossed by moderately deep drainageways, but in places drainageways are shallow. The moderately deep Amor soil is on side slopes. It has convex, long, smooth slopes. The shallow Cabba soil is on knobs and ridges. It has convex, short, smooth slopes. Individual areas are irregular in shape and range from about 10 to 100 acres or more in size. They are about 45 to 65 percent Amor soil and 30 to 45 percent Cabba soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Amor soil has a dark grayish brown loam surface layer about 5 inches thick. The subsoil is loam about 18 inches thick. It is brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 30 inches is light brownish gray loam. Below this is light gray soft mudstone. In some places the surface layer and subsoil are fine sandy loam, silt loam, or clay loam. In other places the subsoil is clay loam or silty clay loam. In some areas soft bedrock is at a depth of 40 to 60 inches.

Typically, the Cabba soil has a grayish brown loam surface layer about 4 inches thick. The next layer is very pale brown loam about 5 inches thick. The substratum to a depth of about 13 inches is loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft mudstone. In some places the surface layer and substratum are fine sandy loam, loamy fine sand, silt loam, or silty clay loam. In other places the surface is stony.

Included with these soils in mapping are small areas of Arnegard, Belfield, and Regent soils. These included soils make up about 5 to 10 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Regent soils have a silty clay loam surface layer and subsoil. They occur as areas intermingled with areas of the Amor soil. Also included are some small areas of rock outcrop and a few areas of soils underlain by hard bedrock.

Permeability is moderate in the Amor and Cabba soils. Runoff is rapid on both soils. Available water capacity is low in the Amor soil and very low in the Cabba soil. The organic matter content is high in the Amor soil and moderately low in the Cabba soil. Tilth is good. The soft bedrock restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. The soils are poorly suited to small grain and sunflowers and are suited to grasses and legumes. The hazard of soil blowing is moderate, and that of water erosion is severe. The main concerns in managing cultivated areas are controlling erosion and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, using contour stripcropping, maintaining grassed waterways in areas where runoff concentrates, and constructing terraces help to control soil blowing and water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are needleandthread, western wheatgrass, and little bluestem. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. Soil blowing, droughtiness, and water erosion are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing and water erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Amor soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Cabba soil generally is unsuited to trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a

mound system helps to prevent this pollution. The lower lying areas of the landscape, where the soils tend to be deeper, are better suited as sites for waste disposal.

The land capability classification of the Amor soil is IVe, and that of the Cabba soil is VIe. The range site of the Amor soil is Silty, and that of the Cabba soil is Shallow. The productivity index of the unit for spring wheat is 39.

19F—Cabba-Chama silt loams, 15 to 70 percent slopes. These well drained soils are on uplands. Most areas are crossed by moderately deep drainageways. The shallow, moderately steep to very steep Cabba soil is on knobs and ridges. It has convex, short, uneven slopes. The moderately deep, moderately steep and steep Chama soil is on side slopes. It has convex, moderately long, smooth slopes. Slumps and areas of soil slippage are evident in many areas. Individual areas are irregular in shape and range from about 5 to 100 acres or more in size. They are about 35 to 45 percent Cabba soil and 20 to 45 percent Chama soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Cabba soil has a grayish brown silt loam surface layer about 4 inches thick. The substratum to a depth of about 14 inches is silt loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft siltstone. In some places the surface layer and substratum are fine sandy loam, loamy fine sand, loam, or silty clay loam. In other places the surface is stony.

Typically, the Chama soil has a dark grayish brown, calcareous silt loam surface layer about 6 inches thick. The subsoil is about 25 inches thick. It is calcareous. It is light grayish brown silt loam in the upper part and light yellowish brown silty clay loam in the lower part. Below this is pale olive and gray, soft siltstone. In some places the surface layer and upper part of the subsoil are noncalcareous. In other places the surface layer is silt loam or silty clay loam. In a few places the subsoil is loam. In some areas the soft bedrock is at a depth of 40 to 60 inches.

Included with these soils in mapping are small areas of Arnegard, Belfield, and Savage soils in swales. These included soils make up about 10 to 25 percent of the unit. They are deep. Also included are a few small areas of rock outcrop and some areas of soils underlain by hard bedrock.

Permeability is moderate in the Cabba and Chama soils. Runoff is very rapid on both soils. Available water capacity is very low in the Cabba soil and moderate in the Chama soil. The organic matter content is moderately low in the Cabba soil and moderate in the Chama soil. The siltstone restricts the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas are used for hay or cultivated crops. The soils generally are unsuited to cultivated crops, trees and shrubs, hay, and pasture because of slope and the hazard of erosion. They are best suited to range and wildlife habitat. The hazard of water erosion is very severe, and that of soil blowing is moderate.

In areas where these soils are used as range, the important forage plants are needleandthread, western wheatgrass, green needlegrass, and little bluestem. Droughtiness, soil blowing, and water erosion are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas. Slope limits the use of machinery. Maintaining an adequate cover of the important forage plants at a height that traps snow helps to prevent denuding, control soil blowing and water erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

These soils are poorly suited to buildings and septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent from septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. Slope is a limitation for mound systems and buildings. This limitation can be overcome by designing buildings and mound systems to conform to the natural slope of the land.

The land capability classification of both soils is VIIe. The range site of the Cabba soil is Shallow, and that of the Chama soil is Silty. The productivity index of the unit for spring wheat is 0.

20F—Flasher-Beisigl-Parshall complex, 6 to 70 percent slopes, extremely stony. These soils are on uplands. Most areas are crossed by moderately deep drainageways. The shallow, strongly sloping to very steep, somewhat excessively drained Flasher soil is on knobs and ridges. It has convex, short, uneven slopes. The moderately deep, moderately sloping to very steep, somewhat excessively drained Beisigl soil is on side slopes. It has convex, moderately long, uneven slopes.

The deep, moderately sloping, well drained Parshall soil is on foot slopes. It has concave, moderately long, smooth slopes. Slumps and areas of soil slippage are evident in most areas. About 10 to 40 percent of the surface of the Flasher and Beisigl soils is covered with silcrete or sandstone boulders and stones. The stones range in size from less than 10 inches to more than 4 feet. Only a few stones are on the surface of the Parshall soil. Individual areas are irregular in shape and range from about 10 to 400 acres in size. They are about 30 to 50 percent Flasher soil, 20 to 40 percent Beisigl soil, and 15 to 35 percent Parshall soil. The three soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Flasher soil has a light brownish gray loamy fine sand surface layer about 4 inches thick. The next layer is light yellowish brown loamy fine sand about 11 inches thick. Below this is light gray and pale yellow soft sandstone. In some places the soil is fine sandy loam or loam over soft sandstone.

Typically, the Beisigl soil has a grayish brown loamy fine sand surface layer about 2 inches thick. The subsoil is loamy fine sand about 22 inches thick. It is pale brown in the upper part and light yellowish brown in the lower part. Below this is pale yellow, brownish yellow, and light yellowish brown, soft sandstone. In some places the surface layer and subsoil are fine sandy loam or loam. In a few places soft sandstone is at a depth of more than 40 inches.

Typically, the Parshall soil has a very dark grayish brown fine sandy loam surface soil about 10 inches thick. The subsoil to a depth of about 60 inches is fine sandy loam. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. In some places the surface layer and subsoil are loamy fine sand.

Included with these soils in mapping are small areas of Amor, Belfield, Reeder, and Yegen soils. These included soils make up about 10 to 20 percent of the unit. They have a subsoil that contains more clay than that of the Beisigl, Flasher, and Parshall soils. The Amor and Reeder soils are on side slopes. The Belfield and Yegen soils are on flats and in swales. Also included are a few areas of sandstone outcrop and some areas of soils underlain by hard sandstone.

Permeability is rapid in the Beisigl and Flasher soils and moderately rapid in the Parshall soil. Runoff is very rapid on all three soils. Available water capacity is very low in the Flasher and Beisigl soils and moderate in the Parshall soil. The organic matter content is low in the Flasher soil, moderately low in the Beisigl soil, and moderate in the Parshall soil. The sandstone in the Beisigl and Flasher soils may restrict the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas of the Parshall soil are used for hay or cultivated crops. These soils generally are unsuited to cultivated crops, hay, and pasture because of stoniness, slope, and droughtiness. They are suited to range and wildlife habitat. The hazard of soil blowing is very severe, and that of water erosion is severe.

In areas where these soils are used as range, the important forage plants are prairie sandreed, needleandthread, and little bluestem. Soil blowing, droughtiness, and water erosion are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Flasher and Beisigl soils. Slope and stones limit the use of machinery. Maintaining an adequate cover of the important forage plants at a height that traps snow helps to prevent denuding, control erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Parshall soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Flasher and Beisigl soils generally are unsuited to trees and shrubs. Little benefit is derived from fallowing the Parshall soil in the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect the seedlings from abrasion.

The Beisigl and Flasher soils are poorly suited to buildings and septic tank absorption fields. The Parshall soil is well suited to these uses. The effluent in septic tank absorption fields may follow bedding planes in the bedrock in the Flasher and Beisigl soils and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. Slope is a limitation for buildings and mound systems, but it can be overcome by designing buildings and mound systems to conform to the natural slope of the land. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification of the Flasher and Beisigl soils is VIIe, and that of the Parshall soil is IVe. The range site of the Flasher soil is Shallow, that of the

Beisigl soil is Sands, and that of the Parshall soil is Sandy. The productivity index of the unit for spring wheat is 0.

21B—Ruso fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on flats on terraces. Most areas are crossed by indistinct or shallow drainageways. Slopes are plane or convex and are long and smooth. Individual areas are irregular in shape and range from about 10 to 500 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 6 inches thick. The subsoil is about 24 inches thick. It is brown. It is fine sandy loam in the upper part and sandy loam in the lower part. The substratum to a depth of about 60 inches is pale brown gravelly loamy sand. In some places the dark color of the surface layer extends to a depth of only 7 inches or to as much as 16 inches. In a few places the depth to gravel is 40 to 60 inches. In other places the surface layer and subsoil are loam. In a few areas the subsoil and substratum are gravelly fine sandy loam or gravelly loam.

Included with this soil in mapping are small areas of Ekalaka, Shambo, and Lehr soils. These soils make up about 10 to 20 percent of the unit. The Ekalaka soils have a dense, alkali subsoil. They are in swales. The Shambo soils have a loam substratum. They are in swales. The Lehr soils have a gravelly substratum at a depth of 20 inches or less. They are on escarpments.

Permeability is moderately rapid in the upper part of the Ruso soil and very rapid in the lower part. Runoff is slow. Available water capacity is low. The organic matter content is moderate. Tilth is good. The substratum restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is suited to spring-seeded small grain and sunflowers. It is well suited to grasses and legumes and to fall-seeded small grain. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing, overcoming droughtiness, and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, and minimizing summer fallow help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow and using conservation tillage help to improve the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are prairie sandreed and needleandthread. Western wheatgrass, crested wheatgrass, and alfalfa are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

This soil is suited to some of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is low. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is well suited to buildings and is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in pollution of ground water. Using a mound system helps to prevent this pollution. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 48.

22—Bowdle loam, 0 to 3 percent slopes. This deep, level and nearly level, well drained soil is on flats on terraces. Most areas are crossed by indistinct or shallow drainageways. Slopes are plane, long, and smooth. Individual areas are irregular in shape and range from about 5 to 250 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is brown loam about 22 inches thick. The substratum to a depth of about 60 inches is light yellowish brown very gravelly sand. In some places the dark color of the surface layer extends to a depth of only 8 inches or to as much as 16 inches. In other places sand and gravel are at a depth

of 40 to 60 inches. In a few places the surface layer and subsoil are fine sandy loam.

Included with this soil in mapping are small areas of Lehr soils and poorly drained soils in oxbows. These soils make up about 1 to 10 percent of the unit. The Lehr soils have sand and gravel at a depth of 10 to 20 inches. They are on escarpments and also occur as areas intermingled with areas of the Bowdle soil.

Permeability is moderate in the upper part of the Bowdle soil and rapid in the lower part. Runoff is slow. Available water capacity is moderate. The organic matter content is high. Tilth is good. The substratum restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is suited to spring-seeded small grain and sunflowers. It is well suited to fall-seeded small grain and to grasses and legumes. Soil blowing and water erosion are slight hazards. The main concerns in managing cultivated areas are overcoming droughtiness and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface helps to control erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow and using conservation tillage to improve the rate of water infiltration help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to some of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is well suited to buildings and is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to prevent this pollution. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification is IIIs. The range site is Silty. The productivity index for spring wheat is 60.

22B—Bowdle loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on rises on terraces. Most areas are crossed by shallow drainageways, but in some places drainageways are moderately deep. Slopes are plane or convex and are moderately long and smooth. Individual areas are irregular in shape and range from about 10 to 250 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is brown loam about 22 inches thick. The substratum to a depth of about 60 inches is light yellowish brown very gravelly sand. In some places the substratum is gravelly loam. In other places the dark color of the surface layer extends to a depth of only 8 inches or to as much as 16 inches. In a few places sand and gravel are at a depth of 40 to 60 inches. In a few areas the surface layer and subsoil are fine sandy loam.

Included with this soil in mapping are small areas of Amor and Lehr soils. These soils make up about 1 to 15 percent of the unit. They are on escarpments and also occur as areas intermingled with areas of the Bowdle soil. The Amor soils are moderately deep. The Lehr soils have sand and gravel at a depth of 10 to 20 inches.

Permeability is moderate in the upper part of the Bowdle soil and is rapid in the lower part. Runoff is medium. Available water capacity is moderate. The organic matter content is high. Tilth is good. The substratum restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. The soil is suited to spring-seeded small grain and sunflowers. It is well suited to fall-seeded small grain and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are overcoming droughtiness, controlling water erosion, and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding

organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow and using conservation tillage to improve the rate of water infiltration help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion.

This soil is suited to some of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is well suited to buildings and is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to prevent this pollution. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification is IIIe. The range site is Silty. The productivity index for spring wheat is 54.

24—Straw loam, 0 to 3 percent slopes. This deep, level and nearly level, well drained soil is on flood plains and terraces. It is subject to rare periods of flooding. Most areas are crossed by a few indistinct drainageways. Slopes generally are plane, long, and smooth, but along terrace edges slopes are short and convex. Individual areas are linear or irregular in shape and range from about 5 to 50 acres in size.

Typically, the surface soil is loam about 30 inches thick. It is very dark grayish brown in the upper part, dark grayish brown in the next part, and grayish brown in the lower part. The substratum to a depth of about 60 inches is clay loam. It is pale brown in the upper part, grayish brown in the next part, and pale brown in the lower part. In some places the surface layer is stratified loam and fine sandy loam. In other places the dark color of the surface soil extends to a depth of only 5 to 20 inches. In a few places the surface layer and substratum are clay loam or silty clay loam.

Included with this soil in mapping are small areas of Belfield soils and very poorly drained soils in oxbows. These included soils make up about 5 to 20 percent of the unit. The Belfield soils have an alkali subsoil. They occur as areas intermingled with areas of the Straw soil. Also included are some areas of moderately saline soils and a few areas of soils on steep escarpments.

Permeability is moderate in the Straw soil. Runoff is slow. This soil receives runoff from adjacent soils. Available water capacity and the organic matter content are high. Tilth is good.

Most areas of this soil are used for cultivated crops. Some small, isolated areas are used as range or wildlife habitat. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concern in managing cultivated areas is maintaining tilth and fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface and minimizing summer fallow help to control localized soil erosion. Conservation tillage also provides food and cover for wildlife. Adding organic material into the plow layer helps to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. No critical limitations affect the use of this soil for trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth of the seedlings. This soil supports small, scattered stands of native trees.

This soil generally is unsuited to buildings and septic tank absorption fields because of flooding. Soils better suited to these uses generally are nearby.

The land capability classification is IIc. The range site is Silty. The productivity index for spring wheat is 87.

25B—Lihen loamy fine sand, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on flats and rises on terraces and in swales on uplands. Most areas are crossed by shallow

drainageways, but in places drainageways are moderately deep. Slopes generally are concave, moderately long, and smooth. Individual areas are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface soil is dark grayish brown loamy fine sand about 15 inches thick. The next layer is grayish brown loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is light brownish gray loamy fine sand. In some places the surface soil is calcareous. In other places the soil is noncalcareous to a depth of more than 40 inches. In a few places the surface layer and subsoil are fine sandy loam. In a few areas the substratum is gravelly sand.

Included with this soil in mapping are small areas of Amor, Arnegard, and Beisigl soils. These soils make up about 5 to 30 percent of the unit. The Amor and Beisigl soils are moderately deep. They are on slight rises and side slopes. The Arnegard soils are loam throughout. They are in swales.

Permeability is rapid in the Lihen soil. Runoff is slow. Available water capacity is low. The organic matter content is moderately low. Tilth is good.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. The soil is poorly suited to spring-seeded small grain and sunflowers. It is suited to fall-seeded small grain and to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are overcoming droughtiness and controlling soil blowing. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, stripcropping, and including grasses and legumes in the rotation help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility and increase available water capacity. Using plants as barriers to trap snow and using conservation tillage to improve the rate of water infiltration help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are needleandthread and prairie sandreed. Sand bluestem, slender wheatgrass, and sweetclover are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, overcome droughtiness, and control soil blowing.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is low. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and prevent abrasion.

This soil is well suited to buildings and is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to prevent this pollution. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification is IVe. The range site is Sands. The productivity index for spring wheat is 51.

26—Regan loam, 0 to 3 percent slopes. This deep, level and nearly level, poorly drained, highly calcareous, moderately saline soil is in drainageways and basins on uplands. It is occasionally flooded. Slopes are concave, long, and smooth. In some places the surface has relief characterized by micromounds and microdepressions. Individual areas are linear or irregular in shape and range from about 5 to 400 acres in size.

Typically, the surface layer is dark gray loam about 8 inches thick. The subsoil is loam about 26 inches thick. It is light gray in the upper part and white in the lower part. The substratum to a depth of about 60 inches is pale yellow loam. In some places the subsoil and substratum are silt loam or fine sandy loam. In a few places the subsoil is noncalcareous. In other places the lower part of the subsoil is pale yellow.

Included with this soil in mapping are small areas of Harriet, Heil, and Straw soils. These soils make up about 5 to 20 percent of the unit. The Harriet and Heil soils have a dense, alkali subsoil. They occur as areas intermingled with areas of the Regan soil. The well drained Straw soils are on the perimeter of drainageways.

Permeability is moderate in the Regan soil. Runoff is very slow. This soil receives runoff and seepage from adjacent soils. Available water capacity and the organic matter content are high. A seasonal high water table is at the surface to 1 foot below the surface. Tilth is good.

Most areas of this soil are used for range, hay, or wetland wildlife habitat. Some areas are used for cultivated crops. Because of salinity and wetness, this soil is poorly suited to cultivated crops. It is best suited to range. Areas that are used for cultivated crops generally become more saline, because the salts tend to move to the surface when the soil is bare. Suitable drainage outlets generally are difficult to locate. As a result, few areas are drained. The hazard of soil blowing is moderate, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and salinity and overcoming wetness. Applying a system of conservation tillage that includes leaving crop residue on the surface and continuous cropping help to control soil blowing and salinity. Establishing windbreaks and stripcropping also help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility and maintain tilth.

In areas where this soil is used as range, the important forage plants are little bluestem, big bluestem, and prairie cordgrass. Big bluestem, indiangrass, and slender wheatgrass are suitable hay and pasture plants. Soil blowing is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to prevent soil blowing. Stock water reservoir sites generally are available in areas of this soil; however, the reservoirs sometimes contain salty water.

This soil is suited to only a few of the most salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Individual trees and shrubs vary in height, density, and vigor. They are affected by the limited amount of water available to plants because of the salts in the soil. Reducing the evaporation rate at the surface improves seedling survival rates. When the bare surface dries, salt-laden water tends to move to the surface. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protects seedlings from abrasion.

This soil generally is unsuited to buildings and septic tank absorption fields because of flooding and the seasonal high water table. Soils better suited to these uses generally are nearby.

The land capability classification is IIIs. The range site is Subirrigated. The productivity index for spring wheat ranges from 30 to 65, depending on the degree of drainage.

27E—Sinnigam-Daglum complex, 1 to 25 percent slopes. These soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. The shallow, nearly level and gently sloping, well drained Sinnigam soil is on summits and shoulder slopes. Slopes are plane or convex and are moderately long and smooth. The moderately deep, gently sloping to moderately steep, well drained and moderately well drained, alkali Daglum soil is on foot slopes and side slopes. Slumps or soil slippage are evident in most areas. About 10 to 25 percent of the surface of the Daglum soil is covered by silcrete stones. Individual areas are irregular in shape and range from about 10 to 400 acres or more in size. They are 65 to 85 percent Sinnigam soil and 10 to 30 percent Daglum soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Sinnigam soil has a brown loam surface layer about 5 inches thick. The subsoil is about 12 inches thick. It is brown flaggy clay loam in the upper part and pale brown very flaggy clay loam in the lower part. Below this is hard silcrete. In some places the depth to hard bedrock is 20 to 40 inches. In other places soft shale is at a depth of 10 to 20 inches. In a few places, the flaggy subsoil does not occur and the substratum is white or light gray clay. In other areas the surface layer is clay loam.

Typically, the Daglum soil has a grayish brown clay loam surface layer about 5 inches thick. The subsurface layer is pale brown clay loam about 2 inches thick. The next layer is light yellowish brown clay loam about 2 inches thick. The subsoil is about 20 inches thick. It is light yellowish brown clay in the upper part, light yellowish brown clay loam in the next part, and very pale brown loam in the lower part. Below this is light brownish gray, soft shale. In some places the surface layer is loam or silty clay loam. In other places the subsoil is at a depth of 2 to 5 inches. In a few places soft bedrock is below a depth of 40 inches.

Included with these soils in mapping are small areas of Arnegard, Moreau, and Savage soils. These included soils make up about 10 to 30 percent of the unit. The Arnegard and Savage soils are nonalkali and deep. They are in swales. The Moreau soils have a silty clay surface layer and subsoil. They occur as areas intermingled with areas of the Sinnigam soil. Also included are a few areas of soils on steep escarpments.

Permeability is moderately slow in the Sinnigam soil and very slow in the Daglum soil. Runoff is medium on the Sinnigam soil and very rapid on the Daglum soil. Available water capacity is very low in the Sinnigam soil and low in the Daglum soil. The organic matter content is low in the Sinnigam soil and moderate in the Daglum soil. The bedrock in the Sinnigam soil and the dense, alkali subsoil in the Daglum soil restrict the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some of the less sloping areas, where the stones have been removed, are used for cultivated crops. These soils generally are unsuited to small grain, sunflowers, trees and shrubs, and grasses and legumes because of stoniness, droughtiness, and slope. They are best suited to range and wildlife habitat. The hazard of soil blowing is slight on both soils. The hazard of water erosion on the Sinnigam soil is moderate, and that on the Daglum soil is very severe.

In areas where these soils are used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Droughtiness in the Sinnigam soil, the dense subsoil and salts in the Daglum soil, and water erosion on both soils are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to overcome droughtiness and control erosion. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

These soils generally are unsuited to buildings and septic tank absorption fields because of stoniness, depth to bedrock, and slow permeability. Soils better suited to these uses generally are nearby.

The land capability classification of the Sinnigam soil is VIs, and that of the Daglum soil is VIIs. The range site of the Sinnigam soil is Shallow to Gravel, and that of the Daglum soil is Claypan. The productivity index of the unit for spring wheat is 0.

28—Harriet loam. This deep, level, poorly drained, alkali, strongly saline soil is on flood plains and in basins on uplands. It is occasionally flooded. Slopes are plane, moderately long, and smooth. In some places the surface has relief that is characterized by micromounds and microdepressions. Individual areas are linear or circular in shape and range from about 10 to 500 acres or more in size.

Typically, the surface layer is gray loam about 4 inches thick. The subsoil is clay about 36 inches thick. It is dark grayish brown in the upper part, grayish brown in the middle part, and light brownish gray in the lower part. It is mottled between depths of 26 and 40 inches. The substratum to a depth of about 60 inches is light brownish gray, mottled clay. In some places the surface layer is silt loam or clay loam. In a few places the surface layer and subsoil are noncalcareous. In other places the substratum is stratified sandy loam and loam. In some areas the soil is not saline.

Included with this soil in mapping are small areas of Belfield and Rhoades soils. These included soils make up about 5 to 15 percent of the unit. The Belfield and Rhoades soils are well drained and moderately well drained. They are on rises and on the perimeter of basins and drainageways.

Permeability is very slow in the Harriet soil. Runoff also is very slow. Available water capacity is moderate. The organic matter content is high. The salts in the soil limit the amount of water available to plants. A seasonal high water table is at the surface to 1 foot below the surface. The dense, alkali subsoil restricts the depth to which plant roots can penetrate.

Most areas of this soil are used as range. A few areas are used for cultivated crops, hay, or pasture. Because of alkalinity, salinity, and wetness, this soil generally is unsuited to cultivated crops and trees and shrubs. It is poorly suited to grasses and legumes and is best suited to range. Areas used for cultivated crops generally become more saline, because the salts tend to move to the surface when the soil is bare. Soil blowing and water erosion are slight hazards.

In areas where this soil is used as range, the important forage plants are western wheatgrass, Nuttall alkaligrass, inland saltgrass, and prairie cordgrass. Tall wheatgrass, western wheatgrass, and altai wildrye are suitable hay and pasture plants. Compaction, trampling, and root shearing are problems, especially if the range is grazed when the soil is wet. These problems can be overcome by deferring grazing when the soil is wet. Stock water reservoir sites generally are available in areas of this soil; however, the reservoirs frequently contain salty water.

This soil generally is unsuited to buildings and septic tank absorption fields because of flooding, the seasonal high water table, very slow permeability, and the high shrink-swell potential. Soils better suited to these uses generally are nearby.

The land capability classification is VIs. The range site is Saline Lowland. The productivity index for spring wheat is 0.

29—Korchea loam, 0 to 3 percent slopes. This deep, level and nearly level, well drained soil is on flood plains (fig. 8). It is occasionally flooded. Slopes generally are plane, long, and smooth, but along escarpments slopes are short and convex. Individual areas are linear or irregular in shape and range from about 5 to 250 acres in size.

Typically, the surface layer is grayish brown and dark grayish brown, stratified loam about 8 inches thick. The substratum extends to a depth of about 60 inches. In sequence downward, it is light brownish gray, stratified loam and silt loam; grayish brown loam; light brownish gray loam; grayish brown clay loam; and grayish brown sandy loam. In some places the surface layer and substratum are clay loam or fine sandy loam. In other places the dark color of the surface layer extends to a depth of 16 inches or more.

Included with this soil in mapping are small areas of Belfield soils and very poorly drained soils in oxbows. These included soils make up about 5 to 15 percent of the unit. The Belfield soils have an alkali subsoil. They are in swales. Also included are some areas of moderately saline soils and a few areas of soils on steep escarpments.

Permeability is moderate in the Korchea soil. Runoff is slow. Available water capacity is high. The organic matter content is moderate. Tilth is good.

Most areas of this soil are used for cultivated crops. Some small, isolated areas are used as range or wildlife habitat. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concern in managing cultivated areas is maintaining tilth and fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface and minimizing summer fallow help to control localized soil erosion. Conservation tillage also provides food and cover for wildlife. Adding organic materials into the plow layer helps to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are big bluestem, green needlegrass, and western wheatgrass. Crested wheatgrass, slender wheatgrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. No critical limitations affect the use of this soil for trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. This soil supports small, scattered stands of native trees.

This soil generally is unsuited to septic tank absorption fields and buildings because of flooding. Soils better suited to these uses generally are nearby.

The land capability classification is IIc. The range site is Silty. The productivity index for spring wheat is 84.

30—Straw loam, channeled. This deep, level, well drained soil is on flood plains. It is frequently flooded. Most areas occupy narrow valleys, but some areas are on broad bottom lands. They are dissected by meandering stream channels. Slopes are plane, short, and smooth. Individual areas are linear in shape and range from about 50 to 250 acres in size.

Typically, the surface soil is loam about 30 inches thick. It is very dark grayish brown in the upper part, dark grayish brown in the next part, and grayish brown in the lower part. The substratum to a depth of about 60 inches is clay loam. It is pale brown in the upper part, grayish brown in the next part, and pale brown in the lower part. In some places the surface layer is stratified loam and fine sandy loam. In other places the dark color of the surface soil extends to a depth of 5 to 20 inches. In a few places the surface layer is clay loam or silty clay loam.

Included with this soil in mapping are small areas of Belfield, Harriet, and Rhoades soils and very poorly drained soils in oxbows. These included soils make up about 15 to 30 percent of the unit. They have a dense, alkali subsoil. The Belfield and Rhoades soils occur as areas intermingled with areas of the Straw soil. The Harriet soils are adjacent to drainageways. Also included are a few areas of soils on steep escarpments.

Permeability is moderate in the Straw soil. Runoff is slow. Available water capacity and the organic matter content are high.

Most areas of this soil are used as range. A few areas are used for cultivated crops. Because of the entrenched meandering stream channels, steep sides of valleys, abandoned stream channels, and escarpments and the hazard of flooding, this soil generally is unsuited to cultivated crops. Tillable areas generally are small and irregular in shape.

In areas where this soil is used as range, the important forage plants are big bluestem and green needlegrass. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major problems affect the use of this soil for range or pasture. Stock water reservoir sites generally are available in areas of this soil.

Figure 8.—Typical area of Korchea loam, 0 to 3 percent slopes. This soil is occasionally flooded.

This soil generally is unsuited to trees and shrubs grown as windbreaks and environmental plantings. It supports small, scattered stands of native trees and shrubs. Trees and shrubs grown for esthetic or wildlife purposes can be planted if special treatment, such as hand planting or scalp planting, is applied.

This soil generally is unsuited to buildings and septic tank absorption fields because of flooding. Soils better suited to these uses generally are nearby.

The land capability classification is VIw. The range site is Overflow. The productivity index for spring wheat is 0.

33—Savage clay loam, 1 to 3 percent slopes. This deep, nearly level, well drained soil is on flats on terraces and uplands. Most areas are crossed by shallow drainageways. Slopes generally are plane, long, and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The subsoil is about 44 inches thick. It is grayish brown silty clay in the upper part, grayish brown silty clay loam in the next part, and pale olive silty clay loam in the lower part. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In a few places the surface layer is silty clay loam, loam, or silty clay. In other places the soil is calcareous throughout. In some areas soft shale is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Daglum, Moreau, and Yegen soils. These soils make up about 1 to 15 percent of the unit. The Daglum soils have a dense, alkali subsoil. They are in swales. The Moreau and Yegen soils are on rises. The Moreau soils are moderately deep. The Yegen soils have a clay loam and loam subsoil and a fine sandy loam substratum.

Permeability is slow in the Savage soil. Runoff also is slow. Available water capacity is high. The organic

matter content is moderate. Tilth is fair.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are improving tilth and maintaining fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized soil erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and green needlegrass. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification is IIc. The range site is Clayey. The productivity index for spring wheat is 86.

33B—Savage clay loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes generally are plane, long, and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The subsoil is about 44 inches thick. It is grayish brown silty clay in the upper part, grayish brown silty clay loam in the next part, and pale olive silty clay loam in the lower part. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam. This soil is calcareous at a depth of about 25 to 60 inches. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In a few places the surface layer is silty clay loam, loam, or silty clay. In other places the soil is calcareous throughout. In some areas soft shale is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Amor, Daglum, and Moreau soils. These soils make up about 1 to 15 percent of the unit. The Amor and Moreau soils are moderately deep. They are on slight rises. The Daglum soils have a dense, alkali subsoil. They are in swales.

Permeability is slow in the Savage soil. Runoff is medium. Available water capacity is high. The organic matter content is moderate. Tilth is fair.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion, improving tilth, and maintaining fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and green needlegrass. Western wheatgrass, crested wheatgrass, and alfalfa are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to prevent erosion. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing

foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification is IIe. The range site is Clayey. The productivity index for spring wheat is 75.

34F—Brandenburg-Cabba-Savage complex, 6 to 70 percent slopes. These soils are on uplands. Most areas are crossed by moderately deep drainageways. The deep, moderately sloping to very steep, excessively drained Brandenburg soil is on ridges and cone-shaped hills. It has convex, short, uneven slopes. The shallow, moderately sloping to very steep, well drained Cabba soil is on hills and ridges. It has convex, short, uneven slopes. The deep, moderately sloping and strongly sloping, well drained Savage soil is on side slopes and on foot slopes between hills and ridges. It has concave, short, smooth slopes. Slumps and areas of soil slippage are evident in most areas. Scattered stones and clinkers are characteristic of most areas. Individual areas are irregular in shape and range from about 5 to 500 acres in size. They are 35 to 60 percent Brandenburg soil, 20 to 40 percent Cabba soil, and 25 to 35 percent Savage soil. The three soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Brandenburg soil has a brown channery loam surface layer about 4 inches thick. The substratum to a depth of about 60 inches is light brown very channery loam in the upper part and pinkish white and light red, shattered porcellanite (scoria) in the lower part. In some places the depth to porcellanite is more than 20 inches. In other places the surface layer is thicker and darker colored. In a few places the surface layer is channery fine sandy loam.

Typically, the Cabba soil has a grayish brown loam surface layer about 4 inches thick. The substratum to a depth of about 13 inches is loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft mudstone. In some places the surface layer and substratum are fine sandy loam, loamy fine sand, or silt loam.

Typically, the Savage soil has a dark grayish brown clay loam surface layer about 7 inches thick. The subsoil is about 44 inches thick. It is grayish brown silty clay in the upper part, grayish brown silty clay loam in the next part, and pale olive silty clay loam in the lower part. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam. In some places the surface layer and subsoil are loam. In other places the dark color of the surface layer extends to a depth of more than 16 inches. In a few places the substratum has porcellanite (scoria) fragments.

Included with these soils in mapping are small areas of Amor, Arnegard, and Daglum soils. These included soils make up about 5 to 15 percent of the unit. The Amor soils are moderately deep. They are on side slopes. The Arnegard and Daglum soils are in swales. The Arnegard soils are deep and have a loam subsoil and substratum. The Daglum soils have a dense, alkali subsoil. Also included are a few small areas of rock outcrop and some areas of soils underlain by hard bedrock.

Permeability is moderate in the upper part of the Brandenburg soil and very rapid in the lower part. It is moderate in the Cabba soil and slow in the Savage soil. Runoff is rapid on the Brandenburg and Savage soils and very rapid on the Cabba soil. Available water capacity is very low in the Brandenburg and Cabba soils and is high in the Savage soil. The organic matter content is moderately low in the Cabba soil and moderate in the Brandenburg and Savage soils. The bedrock in the Cabba soil and the porcellanite in the Brandenburg soil restrict the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas of the Savage soil are used for cultivated crops or hay. Some areas of the Brandenburg soil have been mined for porcellanite (scoria). These soils generally are unsuited to cultivated crops, hay, and pasture because of slope and droughtiness of the Brandenburg and Cabba soils. They are best suited to range and wildlife habitat. The hazard of water erosion is very severe on all three soils. The hazard of soil blowing on the Cabba soil is moderate, and that of the Brandenburg and Savage soils is slight.

In areas where these soils are used as range, the important forage plants are needleandthread, western wheatgrass, little bluestem, prairie sandreed, and blue grama. Droughtiness in the Cabba and Brandenburg soils, soil blowing on the Cabba soil, and water erosion on all three soils are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas. Slope limits the use of machinery. Maintaining an adequate cover of the important forage plants at a height that traps snow helps to prevent denuding, control erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Savage soil is suited to nearly all of the climatically adapted trees and shrubs grown as

windbreaks and environmental plantings. The Brandenburg and Cabba soils generally are unsuited to trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are poorly suited to buildings and septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling.

The effluent in septic tank absorption fields may follow bedding planes in the bedrock of the Cabba soil and surface downslope or pollute ground water. The Brandenburg soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to prevent this pollution. Slow permeability of the Savage soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system. Slope is a limitation for mound systems and building sites. This limitation can be overcome by designing mound systems and buildings to conform to the natural slope of the land.

The land capability classification of the Brandenburg soil is VIIs, that of the Cabba soil is VIIe, and that of the Savage soil is IVe. The range site of the Brandenburg soil is Very Shallow, that of the Cabba soil is Shallow, and that of the Savage soil is Clayey. The productivity index of the unit for spring wheat is 0.

35F—Cabba-Amor-Savage complex, 9 to 70 percent slopes, extremely stony. These well drained soils are on uplands. Most areas are crossed by moderately deep drainageways. The shallow, strongly sloping to very steep Cabba soil is on knobs and ridges. It has convex, short, uneven slopes. The moderately deep, strongly sloping and moderately steep Amor soil is on upper side slopes. It has convex, short, smooth slopes. The deep, strongly sloping Savage soil is on lower side slopes and on foot slopes between knobs and ridges. It has concave, moderately long, smooth slopes. Slumps and areas of soil slippage are evident in most areas. From 10 to 40 percent of the surface of the Cabba and Amor soils is covered by silcrete stones and boulders. The stones and boulders range in size from 10 inches to more than 4 feet. Only a few stones are on the surface of the Savage soil. Individual areas are irregular in shape and range from 5 to 500 acres in size. They are 35 to 65 percent Cabba soil, 20 to 45 percent Amor soil, and 10 to 25 percent Savage soil. The three soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Cabba soil has a grayish brown loam surface layer about 4 inches thick. The substratum to a depth of about 13 inches is loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft mudstone. In some places the surface layer and substratum are fine sandy loam, loamy fine sand, or silt loam.

Typically, the Amor soil has a dark grayish brown loam surface layer about 5 inches thick. The subsoil is loam about 18 inches thick. It is brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 30 inches is light brownish gray loam. Below this is light brownish gray, soft mudstone. In some places the surface layer and subsoil are fine sandy loam or silt loam. In other places the subsoil is clay loam or silty clay loam.

Typically, the Savage soil has a dark grayish brown clay loam surface layer about 7 inches thick. The subsoil is about 44 inches thick. It is grayish brown silty clay in the upper part, grayish brown silty clay loam in the next part, and pale olive silty clay loam in the lower part. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam. In some places the dark color of the surface layer extends to a depth of 16 inches or more. In a few places the surface layer and subsoil are loam.

Included with these soils in mapping are small areas of Arnegard, Belfield, Brandenburg, and Daglum soils. These included soils make up about 5 to 10 percent of the unit. They are deep. The Arnegard, Belfield, and Daglum soils are in swales. The Arnegard soils have a loam subsoil and substratum. The Belfield and Daglum soils have a dense, alkali subsoil. The Brandenburg soils have a porcellanite (scoria) substratum. They are on knobs. Also included are a few small areas of rock outcrop and a few areas of soils underlain by hard bedrock.

Permeability is moderate in the Cabba and Amor soils and slow in the Savage soil. Runoff is very rapid on the Cabba and Amor soils and rapid on the Savage soil. Available water capacity is very low in the Cabba soil, low in the Amor soil, and high in the Savage soil. The organic matter content is moderately low in the Cabba soil, high in the Amor soil, and moderate in the Savage soil. The bedrock in the Cabba and Amor soils restricts the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some

small areas of the Savage soil are used for cultivated crops or hay. These soils generally are unsuited to cultivated crops, hay, and pasture because of stoniness, the hazard of erosion, and slope. They are best suited to range and wildlife habitat. The hazard of water erosion is very severe on all three soils. The hazard of soil blowing on the Cabba soil is moderate, and that on the Amor and Savage soils is slight.

In areas where these soils are used as range, the important forage plants are needleandthread, western wheatgrass, green needlegrass, and little bluestem. Droughtiness and soil blowing on the Cabba soil and water erosion on all three soils are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Cabba soil. Slope and stones limit the use of machinery. Maintaining an adequate cover of the important forage plants at a height that traps snow helps to prevent denuding, control erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Savage soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Cabba and Amor soils generally are unsuited to these uses. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are poorly suited to buildings and septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling.

The effluent in septic tank absorption fields may follow bedding planes in the bedrock of the Amor and Cabba soils and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. Slow permeability of the Savage soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system. Slope is a limitation for mound systems and building sites. This limitation can be overcome by designing the mound systems and buildings to conform to the natural slope of the land.

The land capability classification of the Cabba soil is VIIs, that of the Amor soil is VIs, and that of the Savage soil is IVe. The range site of the Cabba soil is Shallow, that of the Amor soil is Silty, and that of the Savage soil is Clayey. The productivity index of the unit for spring wheat is 0.

36—Velva fine sandy loam, 0 to 3 percent slopes. This deep, level and nearly level, well drained soil is on flood plains. It is occasionally flooded. Slopes are plane, long, and smooth. Individual areas are linear or irregular in shape and range from about 10 to 250 acres in size.

Typically, the surface layer is stratified, grayish brown and pale brown fine sandy loam about 5 inches thick. The substratum extends to a depth of about 60 inches. In sequence downward, it is grayish brown loam; light brownish gray, stratified fine sandy loam and loam; light yellowish brown fine sandy loam; and light brownish gray fine sandy loam. In some places the soil is loam or loamy fine sand throughout. In other places the dark color of the surface layer extends to a depth of 20 inches or more.

Included with this soil in mapping are small areas of Belfield soils and very poorly drained soils in oxbows. These included soils make up about 5 to 15 percent of the unit. The Belfield soils have an alkali subsoil. They are in swales. Also included are some moderately saline soils and a few areas of soils on steep escarpments.

Permeability is moderately rapid in the Velva soil. Runoff is slow. Available water capacity and the organic matter content are high. Tilth is good.

Most areas of this soil are used for cultivated crops. Some small, isolated areas are used as range or wildlife habitat. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and establishing windbreaks help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are prairie sandreed and needleandthread. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. Soil blowing is a hazard, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding,

control soil blowing, and overcome droughtiness.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. No critical limitations affect the use of this soil for trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. This soil supports small, scattered stands of native trees.

This soil generally is unsuited to buildings and septic tank absorption fields because of flooding. Soils better suited to these uses generally are nearby.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 71.

38—Belfield-Grail clay loams, 0 to 3 percent slopes. These deep, level and nearly level soils are in swales and on broad flats on uplands and terraces. Most areas are crossed by shallow drainageways, but in places drainageways are indistinct. Generally, the well drained and moderately well drained, alkali Belfield soil is in microdepressions and the well drained Grail soil is on micromounds. Slopes are concave or plane and are long and uneven. Individual areas are irregular in shape and range from about 5 to 150 acres in size. They are about 45 to 55 percent Belfield soil and 35 to 50 percent Grail soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Belfield soil has a grayish brown surface layer about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The next 5 inches is grayish brown silty clay loam that has light brownish gray coatings. The subsoil is silty clay about 41 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam, silty clay loam, or silty clay. In a few places the surface layer and subsoil are calcareous.

Typically, the Grail soil has a dark grayish brown surface soil about 12 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. The subsoil is about 29 inches thick. It is grayish brown silty clay in the upper part, light yellowish brown silty clay in the next part, and light yellowish brown silty clay loam in the lower part. The next layer is light yellowish brown clay loam. The substratum to a depth of about 60 inches is light brownish gray clay. In some places the dark color of the surface soil extends to a depth of only 7 inches or to as much as 16 inches. In a few places the surface layer is silt loam or silty clay loam.

Included with these soils in mapping are small areas of Daglum, Regent, and Rhoades soils. These included soils make up about 5 to 15 percent of the unit. The Daglum and Rhoades soils have a dense, alkali subsoil. They occur as areas intermingled with areas of the Belfield and Grail soils. The Regent soils are moderately deep. They are on slight rises. Also included are a few areas of moderately saline soils.

Permeability is slow in the Belfield and Grail soils. Runoff also is slow on both soils. These soils receive runoff from adjacent soils. Available water capacity and the organic matter content are high in both soils. Tilth is fair.

Most areas are used for cultivated crops. These soils are well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are improving tilth and maintaining fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized soil erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where these soils are used as range, the important forage plants are western wheatgrass, big bluestem, and green needlegrass. Crested wheatgrass, green needlegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of these soils for range or pasture. Stock water reservoir sites generally are available in areas of these soils.

The Belfield soil is suited to many and the Grail soil to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are suited to buildings and septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification of the Belfield soil is IIIs, and that of the Grail soil is IIc. The range site of the Belfield soil is Clayey, and that of the Grail soil is Overflow. The productivity index of the unit for spring wheat is 81.

39—Belfield-Grail clay loams, saline, 0 to 3 percent slopes. These deep, level and nearly level, moderately saline soils are in swales and on broad flats on uplands and terraces. Most areas are crossed by shallow drainageways, but in places drainageways are indistinct. Generally, the well drained, alkali Belfield soil is in microdepressions and the well drained Grail soil is on micromounds. Slopes generally are concave or plane and are long and uneven. Individual areas are irregular in shape and range from about 5 to 150 acres in size. They are about 45 to 55 percent Belfield soil and 35 to 50 percent Grail soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Belfield soil has a very dark grayish brown surface layer about 8 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. It has flecks of salt. The next layer is grayish brown silty clay loam that has light brownish gray coatings. It is about 5 inches thick. The subsoil is silty clay about 41 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam, silty clay loam, or silty clay. In a few places the surface layer is lighter colored. In other places the surface layer and subsoil are calcareous.

Typically, the Grail soil has a dark grayish brown surface soil about 12 inches thick. It is clay loam in the upper part and silty clay loam in the lower part. It has flecks of salt. The subsoil is about 29 inches thick. It is grayish brown silty clay in the upper part, light yellowish brown silty clay in the next part, and light yellowish brown silty clay loam in the lower part. The next layer is light yellowish brown clay loam. The substratum to a depth of about 60 inches is light brownish gray clay. In some places the surface layer is silt loam or silty clay loam. In a few places the surface layer is lighter colored.

Included with these soils in mapping are small areas of Daglum and Rhoades soils. These included soils make up about 5 to 15 percent of the unit. They have a dense, alkali subsoil. They occur as areas intermingled with areas of the Belfield and Grail soils. Also included are a few areas of soils that are nonsaline and some strongly saline soils that have a salt crust on the surface.

Permeability is slow in the Belfield and Grail soils. Runoff also is slow on both soils. These soils receive runoff and seepage from adjacent soils. Available water capacity is moderate in both soils. The organic matter content is high in both soils. Salts in both soils limit the amount of water available to plants. A seasonal high water table is at a depth of 3 to 6 feet. Tilth is fair.

Most areas of these soils are used for cultivated crops. Some areas are used as range or for hay. These soils are poorly suited to small grain and sunflowers and to grasses and legumes because of salinity and occasional wetness. They are well suited to range. In years of above average precipitation, seeding is sometimes delayed and occasionally prevented. Areas used for cultivated crops generally become more saline, because the salts tend to move to the surface when the soil is bare. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are overcoming salinity and controlling occasional wetness. Applying a system of conservation tillage that includes leaving crop residue on the surface and minimizing summer fallow help to control erosion. Conservation tillage also traps snow, which helps to leach salts from the surface layer, and it provides food and cover for wildlife. Continuous cropping and growing deep-rooted, salt-tolerant crops help to control the wetness and salinity. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where these soils are used as range, the important forage plant is western wheatgrass. Western wheatgrass, tall wheatgrass, and sweetclover are suitable hay or pasture plants. The high salt content and limited amount of water available to plants are problems, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable, salt-tolerant forage plants helps to prevent salt build-up in the surface layer. Stock water reservoirs constructed in areas of these soils frequently contain salty water.

The Belfield and Grail soils are suited to only a few of the most salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Individual trees and shrubs vary in height, density, and vigor. They are affected by the salts in the soils. Reducing the evaporation rate at the surface improves seedling survival. When the bare surface dries, salt-laden water tends to move to the surface.

These soils are poorly suited to buildings and septic tank absorption fields because of wetness and the shrink-swell potential. Areas of these soils generally are avoided for these uses.

The land capability classification of both soils is IIIs. The range site of both soils is Saline Lowland. The productivity index of the unit for spring wheat is 40.

40—Dumps-Pits complex. This map unit consists of steep mine spoil dumps and nearly level open pits. It is in areas where soil material and overburden have been removed to mine lignite, gravel, or porcellanite (scoria). The soil material and overburden have been mixed in the mining process. Generally, the pits are ponded during part of the year. Individual areas are irregular in shape and range from about 5 to 50 acres in size. The dumps and pits occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Most areas of this unit are abandoned and are not used for any particular purpose, but a few areas are used as landfills. Unless the unit is reclaimed, it generally is best suited to wildlife habitat. The unit supports some grasses, trees, shrubs, and weeds, but plant density is low. Wildlife use some areas for nesting or breeding or as cover. Onsite investigation is necessary to properly plan and design specific uses of this unit.

The land capability classification is VIIIe. A range site is not assigned. The productivity index for spring wheat is 0.

41B—Ekalaka fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained, alkali soil is on flats and rises on uplands. Most areas are crossed by shallow drainageways. Slopes are convex or plane and are short and smooth. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is fine sandy loam about 36 inches thick. It is yellowish brown in the upper part and very pale brown in the lower part. The substratum to a depth of about 60 inches is pale yellow fine sandy loam. In a few places the soil has a subsurface layer; the combined thickness of the surface soil and subsurface layer is 20 to 30 inches. In some places the surface layer is loam. In other places the subsoil is sandy clay loam. In a few areas the surface is stony.

Included with this soil in mapping are small areas of Daglum, Parshall, Rhoades, and Vebar soils. These soils make up about 15 to 35 percent of the unit. The Daglum and Rhoades soils have a subsoil that is clay in the upper part. They occur as areas intermingled with areas of the Ekalaka soil. The dark color of the surface layer in the Parshall soils extends to a depth of more than 16 inches. These soils are in swales. The Vebar soils are moderately deep. They are on side slopes.

Permeability is slow in the Ekalaka soil. Runoff also is slow. Available water capacity is low. The organic matter content is moderately low. The salts in the soil limit the amount of water available to plants. Tilth is fair. The dense, alkali subsoil restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. Because of the dense, alkali subsoil and droughtiness, this soil is poorly suited to small grain and sunflowers. It is suited to grasses, legumes, and range. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, and stripcropping help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain help to overcome droughtiness. Using tillage that loosens the dense, alkali subsoil or growing deep-rooted crops, such as alfalfa and sweetclover, helps to improve root and water penetration.

In areas where this soil is used as range, the important forage plants are needleandthread, blue grama, and prairie sandreed. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. The dense subsoil and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

This soil is suited to only a few of the drought- and salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Supplemental watering, irrigation, and control of ground cover help to ensure survival of seedlings. Individual trees and shrubs vary in height, density, and vigor. They are affected by restricted root development in the dense, alkali subsoil and by the limited amount of water

available to plants because of the salts in the soil. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is well suited to buildings and is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to prevent this pollution. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification is IVe. The range site is Sandy Claypan. The productivity index for spring wheat is 52.

42B—Felor loam, terrace, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on flats and rises on terraces and uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are plane or convex and are moderately long and smooth. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is grayish brown clay loam, pale brown clay loam, pale brown very gravelly sandy loam, and light olive gray silty clay. The substratum to a depth of about 60 inches is light olive gray silty clay. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In some places the surface layer and upper part of the subsoil are loam or fine sandy loam. In a few places the very gravelly sandy loam layer in the subsoil does not occur. In a few areas a thin stone line separates the upper and lower parts of the subsoil.

Included with this soil in mapping are small areas of Bowdle, Moreau, Parshall, and Regent soils. These soils make up about 5 to 20 percent of the unit. The Bowdle, Moreau, and Regent soils occur as areas intermingled with areas of the Felor soil. The Bowdle soils have a very gravelly sand substratum. The Moreau and Regent soils are moderately deep. The Parshall soils have a fine sandy loam surface soil and subsoil. They are in swales. Also included are a few areas of stony soils.

Permeability is moderate in the upper part of the Felor soil and slow in the lower part. Runoff is medium. Available water capacity is high. The organic matter content is moderate. Tilth is good.

Most areas of this soil are used for cultivated crops. The soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Adding organic material into the plow layer helps to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, needleandthread, and green needlegrass. Crested wheatgrass, western wheatgrass, and alfalfa are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 79.

43—Lefor fine sandy loam, 0 to 3 percent slopes. This deep, level and nearly level, well drained soil is on flats on uplands. Most areas are crossed by shallow drainageways. Slopes are plane, long, and smooth. Individual areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 5 inches thick. The next layer is very pale brown fine sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is light yellowish brown loam in the upper part, very pale brown sandy clay loam in the next part, and light yellowish brown fine sandy loam in the lower part. The substratum to a depth

of about 51 inches is very pale brown fine sandy loam. Below this is very pale brown, soft sandstone. In some places the surface layer is loam. In other places the subsoil is fine sandy loam or clay loam. In a few places soft bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Belfield, Ekalaka, and Savage soils. These soils make up 5 to 20 percent of the unit. The Belfield and Ekalaka soils have a dense, alkali subsoil. They are in swales. The Savage soils have a silty clay and silty clay loam subsoil. They occur as areas intermingled with areas of the Lefor soil.

Permeability is moderate in the Lefor soil. Runoff is slow. Available water capacity and the organic matter content are moderate. Natural fertility is low. Tilth is fair.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. This soil is suited to small grain and sunflowers and is well suited to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing, overcoming droughtiness, and improving fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, and stripcropping help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are prairie sandreed and needleandthread. Western wheatgrass, sand bluestem, and meadow bromegrass are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is somewhat droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 62.

43B—Lefor fine sandy loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex, short, and smooth. Individual areas are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface layer is pale brown fine sandy loam about 7 inches thick. The next layer is light yellowish brown loam about 8 inches thick. The subsoil is yellow loam about 23 inches thick. Below this is white and pale yellow, soft sandstone. In a few places the surface layer is loam. In some places the subsoil is fine sandy loam or clay loam. In other places soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Daglum, Flasher, and Shambo soils. These soils make up about 5 to 30 percent of the unit. The Daglum soils have a dense, alkali subsoil. They are in swales. The Flasher soils are shallow. They are on knobs. The Shambo soils are deep. They occur as areas intermingled with areas of the Lefor soil. Also included are some areas of moderately sloping soils.

Permeability is moderate in the Lefor soil. Runoff is slow. Available water capacity and the organic matter content are moderate. Tilth is fair. The soft sandstone restricts the depth to which plant roots can penetrate. Natural fertility is low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. This soil is suited to small grain and sunflowers and is well suited to grasses and legumes. The hazard of soil

blowing is severe, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling erosion, overcoming droughtiness, and improving fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing windbreaks, and stripcropping help to control erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are prairie sandreed and needleandthread. Western wheatgrass, sand bluestem, and meadow bromegrass are suitable hay and pasture plants. Soil blowing, water erosion, and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, overcome droughtiness, and control soil blowing and water erosion.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is somewhat droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 51.

44—Reeder loam, 1 to 3 percent slopes. This moderately deep, nearly level, well drained soil is on flats on uplands. Most areas are crossed by shallow drainageways. Slopes are convex or plane and are long and smooth. Individual areas are irregular in shape and range from about 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 20 inches thick. It is brown clay loam in the upper part, yellowish brown clay loam in the next part, and light brownish gray silt loam in the lower part. Below this is light gray, soft siltstone. In some places the surface layer and subsoil are fine sandy loam or silty clay loam. In other places the soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Belfield, Grail, and Vebar soils. These soils make up about 5 to 20 percent of the unit. The Belfield and Grail soils are deep. They are in swales. The Vebar soils have a fine sandy loam subsoil. They are on slight rises.

Permeability is moderate in the Reeder soil. Runoff is slow. Available water capacity is low. The organic matter content is moderate. Tilth is good. The soft siltstone restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazards of soil blowing and water erosion are slight. The main concerns in managing cultivated areas are maintaining tilth and fertility. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control localized erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and alfalfa are suitable hay and pasture plants. No major hazards affect the use of this soil for range or pasture.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and

environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIc. The range site is Silty. The productivity index for spring wheat is 84.

44B—Reeder loam, 3 to 6 percent slopes. This moderately deep, gently sloping, well drained soil is on rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex, moderately long, and smooth. Individual areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 20 inches thick. It is brown clay loam in the upper part, yellowish brown clay loam in the next part, and light brownish gray silt loam in the lower part. Below this is light gray, soft siltstone. In some places the surface layer and subsoil are fine sandy loam or silty clay loam. In a few places soft bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Arnegard, Belfield, and Cabba soils. These soils make up about 15 to 30 percent of the unit. The Arnegard and Belfield soils are deep. They are in swales. The Cabba soils are shallow. They are on knobs and ridges.

Permeability is moderate in the Reeder soil. Runoff is medium. Available water capacity is low. The organic matter content is moderate. Tilth is good. The soft siltstone restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, range, or pasture. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, establishing contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Crested wheatgrass, western wheatgrass, and sweetclover are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants helps to prevent denuding and control water erosion.

This Reeder soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 77.

45B—Felor loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on summits of buttes. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are plane or convex and are short and smooth. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is brown loam about 4 inches thick. The subsoil is about 37 inches thick. In sequence downward, it is brown loam, brown clay loam, light yellowish brown clay loam, and light brownish gray silty clay. The substratum to a depth of about 60 inches is pink silty clay. In some places soft bedrock is at a depth of 20 to 40 inches. In other places the subsoil

and substratum are loam. In a few places, the surface layer is clay loam and the substratum is silty clay loam. In a few areas a thin stone line separates the upper and lower parts of the subsoil.

Included with this soil in mapping are small areas of Daglum and Wayden soils. These soils make up about 5 to 20 percent of the unit. The Daglum soils have a dense, alkali subsoil. They are in swales. The Wayden soils are shallow. They are on slight rises and on the perimeter of the summits of buttes. Also included are a few areas of very stony soils.

Permeability is moderate in the upper part of the Felor soil and slow in the lower part. Runoff is medium. Available water capacity is high. The organic matter content is moderate. Tilth is good.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. This soil is well suited to small grain and sunflowers and to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion and maintaining tilth. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Crested wheatgrass, western wheatgrass, and alfalfa are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion.

This soil is suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. Slow permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification is IIe. The range site is Silty. The productivity index for spring wheat is 75.

46—Parshall loam, moderately wet, 1 to 3 percent slopes. This deep, nearly level, moderately well drained soil is in drainageways and on flats on uplands. Most areas are crossed by shallow drainageways. Slopes are concave, short, and smooth. Individual areas are linear or irregular in shape and range from 5 to 150 acres in size.

Typically, the surface soil is very dark gray loam about 14 inches thick. The subsoil is fine sandy loam about 25 inches thick. It is very dark gray in the upper part and brown in the lower part. The substratum to a depth of about 60 inches is olive brown, mottled loam. In some places the soil is loam or fine sandy loam throughout. In a few places the soil is saline.

Included with this soil in mapping are small areas of Belfield, Regan, and Vebar soils. These soils make up about 15 to 25 percent of the unit. The Belfield soils have an alkali subsoil. They are in swales and adjacent to drainageways. The Regan soils are poorly drained. They are adjacent to drainageways. The Vebar soils are moderately deep. They are on slight rises.

Permeability is moderately rapid in the Parshall soil. Runoff is slow. This soil receives runoff and seepage from adjacent soils. Available water capacity is moderate. The organic matter content is high. A seasonal high water table is at a depth of 3 to 5 feet. Tilth is good.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. This soil is well suited to small grain and sunflowers and to grasses and legumes. In years of above average precipitation, seeding is sometimes delayed but rarely prevented. The hazards of soil blowing and water erosion are slight; however, soil blowing does occur during some storms. The main concerns in managing cultivated areas are maintaining tilth and fertility and controlling soil blowing. Applying a system of conservation tillage that includes leaving crop residue on the surface and minimizing summer fallow help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Continuous cropping or growing deep-rooted crops, such as alfalfa, helps to control wetness. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility and maintain tilth.

In areas where this soil is used as range, the

important forage plants are prairie cordgrass, big bluestem, and switchgrass. Tall wheatgrass, big bluestem, and alsike clover are suitable pasture and hay plants. No major problems affect the use of this soil for range or pasture. Stock water reservoir sites generally are available in areas of this soil.

This soil is suited to all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. No critical limitations affect the use of this soil for trees and shrubs. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

This soil is suited to buildings and is poorly suited to septic tank absorption fields. The seasonal high water table is a limitation for buildings with basements. Installing a surface and foundation drainage system helps to prevent seepage into basements. The seasonal high water table is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation.

The land capability classification is IIe. The range site is Overflow. The productivity index for spring wheat is 88.

47—Regent-Daglum complex, 1 to 3 percent slopes. These moderately deep, nearly level soils are on uplands. Most areas are crossed by shallow drainageways. In areas of native grass, slopes are convex, moderately long, and smooth. The surface has a characteristic microrelief. The well drained Regent soil is on micromounds, and the well drained and moderately well drained, alkali Daglum soil is in microdepressions. This microrelief is destroyed by cultivation. Individual areas are irregular in shape and range from about 5 to 100 acres in size. They are about 45 to 60 percent Regent soil and 40 to 55 percent Daglum soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Regent soil has a grayish brown silty clay loam surface layer about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. It is grayish brown in the upper part, light brownish gray in the next part, and light yellowish brown in the lower part. Below this is light yellowish brown and pale olive, soft shale. In some places the surface layer is calcareous silty clay or clay. In other places the depth to soft shale is more than 40 inches. In a few places the surface layer and subsoil are silt loam, loam, or clay loam. In a few areas the bedrock is white, noncalcareous shale.

Typically, the Daglum soil has a grayish brown clay loam surface layer about 5 inches thick. The subsurface layer is pale brown clay loam about 2 inches thick. The next layer is light yellowish brown clay loam about 2 inches thick. The subsoil is about 20 inches thick. It is light yellowish brown clay in the upper part, light yellowish brown clay loam in the next part, and very pale brown loam in the lower part. Below this is light brownish gray, soft shale. In some places the surface layer is loam or silty clay loam. In other places soft bedrock is below a depth of 40 inches.

Included with these soils in mapping are small areas of Cabba and Rhoades soils. These included soils make up about 5 to 10 percent of the unit. The Cabba soils are shallow. They are on knobs. The Rhoades soils have salts within a depth of 16 inches. They occur as areas intermingled with areas of the Daglum soil. Also included are a few areas of stony soils.

Permeability is slow in the Regent soil and very slow in the Daglum soil. Runoff is slow on both soils. Available water capacity is low in both soils. The organic matter content is moderate in both soils. The salts in the Daglum soil reduce the amount of water available to plants. The shale bedrock in both soils and the dense, alkali subsoil in the Daglum soil restrict the depth to which plant roots can penetrate. Tilth is fair.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. These soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazards of soil blowing and water erosion are slight. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are improving tilth and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, and maintaining grassed waterways in areas where runoff concentrates help to control erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness. Using tillage that loosens the alkali subsoil of the Daglum soil or growing deep-rooted crops, such as alfalfa or sweetclover, improves root penetration and the rate of water infiltration.

In areas where these soils are used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, slender wheatgrass, and sweetclover are suitable hay and pasture plants. No major hazards affect the use of the Regent soil for range or pasture. The dense, alkali subsoil and salts in the Daglum soil are problems, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Daglum soil. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control erosion, and overcome droughtiness. Stock water reservoir sites generally are available in areas of these soils.

The Regent soil is suited to nearly all and the Daglum soil to only a few of the drought- and salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Individual trees and shrubs grown on these soils vary in height, density, and vigor. Trees and shrubs on the Daglum soil are affected by the restricted root development in the dense, alkali subsoil and the limited amount of water available to plants because of the salts in the soil.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent in septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation and prevent the pollution of ground water.

The land capability classification of the Regent soil is IIc, and that of the Daglum soil is IVs. The range site of the Regent soil is Clayey, and that of the Daglum soil is Claypan. The productivity index of the unit for spring wheat is 63.

47B—Regent-Daglum complex, 3 to 6 percent slopes. These moderately deep, gently sloping soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. In areas of native grass, slopes are convex, moderately long, and smooth. The surface has a characteristic microrelief. The well drained Regent soil is on micromounds, and the well drained and moderately well drained, alkali Daglum soil is in microdepressions. This microrelief is destroyed by cultivation. Individual areas are irregular in shape and range from 5 to 100 acres in size. They are 45 to 65 percent Regent soil and 35 to 50 percent Daglum soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Regent soil has a grayish brown silty clay loam surface layer about 7 inches thick. The subsoil is silty clay loam about 25 inches thick. It is grayish brown in the upper part, light brownish gray in the next part, and light yellowish brown in the lower part. Below this is light yellowish brown and pale olive, soft shale. In some places the surface layer is calcareous silty clay or clay. In other places the depth to soft shale is more than 40 inches. In a few places the surface layer and subsoil are silt loam, loam, or clay loam. In a few areas the bedrock is white, noncalcareous shale.

Typically, the Daglum soil has a grayish brown clay loam surface layer about 5 inches thick. The subsurface layer is pale brown clay loam about 2 inches thick. The next layer is light yellowish brown clay loam about 2 inches thick. The subsoil is about 20 inches thick. It is light yellowish brown clay in the upper part, light yellowish brown clay loam in the next part, and very pale brown loam in the lower part. Below this is light brownish gray, soft shale. In some places the surface layer is loam or silty clay loam. In other places the soft bedrock is at a depth of more than 40 inches.

Included with these soils in mapping are small areas of Cabba and Rhoades soils. These included soils make up about 5 to 10 percent of the unit. The Cabba soils are shallow. They are on knobs. The Rhoades soils have salts within a depth of 16 inches. They occur as areas intermingled with areas of the Daglum soil. Also included are a few areas of stony soils.

Permeability is slow in the Regent soil and very slow in the Daglum soil. Runoff is medium on both soils. Available water capacity is low in both soils. The organic matter content is moderate in both soils. The salts in the Daglum soil limit the amount of water available to plants. Tilth is fair. The shale in both soils and the dense, alkali subsoil in the Daglum soil restrict the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. These soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazard of soil blowing is slight, and that of water

erosion is moderate. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are controlling water erosion, improving tilth, and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, constructing terraces, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness. Using tillage that loosens the alkali subsoil of the Daglum soil or growing deep-rooted crops, such as alfalfa or sweetclover, improves root penetration and the rate of water infiltration.

In areas where these soils are used as range, the important forage plants are western wheatgrass, needleandthread, and blue grama. Crested wheatgrass, slender wheatgrass, and sweetclover are suitable hay and pasture plants. Water erosion and the dense, alkali subsoil and salts in the Daglum soil are concerns, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Daglum soil. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control water erosion, and overcome droughtiness. Stock water reservoir sites generally are available in areas of these soils.

The Regent soil is suited to nearly all and the Daglum soil to only a few of the drought- and salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Individual trees and shrubs grown on these soils vary in height, density, and vigor. Trees and shrubs on the Daglum soil are affected by the restricted root development in the dense, alkali subsoil and the limited amount of water available to plants because of the salts in the soil.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The effluent from septic tank absorption fields may follow bedding planes in the bedrock and surface downslope or pollute ground water. Slow permeability is a limitation in septic tank absorption fields. Using a mound system helps to overcome this limitation and prevent the pollution of ground water.

The land capability classification of the Regent soil is IIe, and that of the Daglum soil is IVs. The range site of the Regent soil is Clayey, and that of the Daglum soil is Claypan. The productivity index of the unit for spring wheat is 57.

48F—Lehr-Shambo-Cabba loams, 6 to 50 percent slopes. These soils are on terrace escarpments. Most areas are crossed by moderately deep drainageways. The deep, moderately sloping and strongly sloping, somewhat excessively drained Lehr soil is on summits and shoulder slopes. It has convex, short, smooth slopes. The deep, moderately sloping and strongly sloping, well drained Shambo soil is on foot slopes. It has concave, moderately long, smooth slopes. The shallow, moderately sloping to very steep, well drained Cabba soil is on side slopes. It has convex, short, smooth slopes. Individual areas are linear or irregular in shape and range from about 5 to 100 acres in size. They are 35 to 65 percent Lehr soil, 25 to 45 percent Shambo soil, and 5 to 20 percent Cabba soil. The three soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Lehr soil has a grayish brown loam surface layer about 5 inches thick. The subsoil is about 10 inches thick. It is grayish brown loam in the upper part and brown clay loam in the lower part. The substratum extends to a depth of about 60 inches. It is pale brown gravelly loamy sand in the upper part and light olive brown and light yellowish brown very gravelly loamy sand in the lower part. In some places the substratum is gravelly loam. In a few places soft bedrock is at a depth of 50 to 60 inches. In other places the surface layer is fine sandy loam.

Typically, the Shambo soil has a dark grayish brown loam surface layer about 6 inches thick. The subsoil is about 39 inches thick. In sequence downward, it is grayish brown loam, light olive brown loam, light yellowish brown loam, and pale yellow clay loam. The substratum to a depth of about 60 inches is pale yellow clay loam. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In

other places the surface layer and subsoil are fine sandy loam or clay loam. In a few places soft bedrock is at a depth of 40 to 60 inches.

Typically, the Cabba soil has a grayish brown loam surface layer about 4 inches thick. The substratum to a depth of about 13 inches is loam. It is very pale brown in the upper part and pale yellow in the lower part. Below this is light gray, soft siltstone. In some places the surface layer is fine sandy loam or loamy fine sand. In a few places soft bedrock is at a depth of 20 to 40 inches. In other places the lower part of the substratum is gravelly loam.

Included with these soils in mapping are small areas of Arnegard, Parshall, and Vebar soils. These included soils make up about 5 to 15 percent of the unit. The dark color of the surface layer in the Arnegard and Parshall soils extends to a depth of more than 16 inches. These soils are in swales. The Vebar soils are moderately deep. They are on side slopes. Also included are some small areas of soils that have sand and gravel at a depth of less than 10 inches.

Permeability is moderately rapid in the upper part of the Lehr soil and very rapid in the lower part. It is moderate in the Shambo and Cabba soils. Runoff is rapid on the Lehr and Shambo soils and very rapid on the Cabba soil. Available water capacity is low in the Lehr soil, high in the Shambo soil, and very low in the Cabba soil. The organic matter content is moderate in the Lehr and Shambo soils and moderately low in the Cabba soil. The bedrock in the Cabba soil and the gravelly substratum in the Lehr soil restrict the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas of the Shambo soil are used for cultivated crops or hay. These soils generally are unsuited to cultivated crops, hay, and pasture because of droughtiness and the steepness of slope. They are best suited to range and wildlife habitat. The hazard of water erosion is severe for all three soils. The hazard of soil blowing on the Cabba soil is moderate, and that on the Lehr and Shambo soils is slight.

In areas where these soils are used as range, the important forage plants are needleandthread, western wheatgrass, prairie sandreed, and little bluestem. Droughtiness in the Lehr and Cabba soils, soil blowing on the Cabba soil, and water erosion on all three soils are hazards, especially if the range is overgrazed. Reestablishing vegetation is difficult in denuded areas of the Lehr and Cabba soils. Slope limits the use of machinery. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control erosion, and overcome droughtiness. Gullies can form along cattle trails. Using a planned grazing system that controls the pattern of livestock traffic helps to prevent gullying.

The Shambo soil is suited to nearly all and the Lehr soil to some of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Cabba soil generally is unsuited to these uses. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are poorly suited to buildings and septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential of the Shambo and Cabba soils is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling.

The effluent in septic tank absorption fields may follow bedding planes in the bedrock of the Cabba soil and surface downslope or pollute ground water. The Lehr soils readily absorb, but do not adequately filter, the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to overcome this limitation. The moderate permeability of the Shambo soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field. Slope is a limitation for septic tank absorption fields, mound systems, and building sites. This limitation can be overcome by designing the mound systems, absorption fields, and buildings to conform to the natural slope of the land.

The land capability classification of the Lehr soil is VIe, that of the Shambo soil is IVe, and that of the Cabba soil is VIIe. The range site of the Lehr soil is Shallow to Gravel, that of the Shambo soil is Silty, and that of the Cabba soil is Shallow. The productivity index of the unit for spring wheat is 0.

49B—Watrous-Felor loams, 1 to 6 percent slopes. These nearly level and gently sloping, well drained soils are on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are indistinct. The moderately deep Watrous soil is on rises and on the edge of the summit of buttes. It has convex, moderately long, smooth slopes. The deep Felor soil is in the center of the summit of buttes. It has plane or concave, moderately long, smooth slopes. Individual areas are irregular in shape and range from about 20 to 400 acres in size. They are about 40 to 55 percent Watrous soil and 25 to 45 percent Felor soil. The two

soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Watrous soil has a dark grayish brown loam surface soil about 12 inches thick. The subsoil is about 12 inches thick. It is grayish brown clay loam in the upper part and light brownish gray channery clay loam in the lower part. Below this is white limestone. In some places the dark color of the surface layer extends to a depth of more than 16 inches. In other places the limestone is at a depth of 10 to 20 inches.

Typically, the Felor soil has a very dark grayish brown loam surface layer about 5 inches thick. The next layer is dark grayish brown loam about 6 inches thick. The subsoil is about 14 inches thick. It is grayish brown clay loam in the upper part and light gray loam in the lower part. The substratum to a depth of about 60 inches is silty clay. It is light gray in the upper part and white in the lower part. In some places the surface layer is silt loam, clay loam, or fine sandy loam. In a few places the silty clay substratum is at a depth of 40 to 60 inches.

Included with these soils in mapping are small areas of Daglum soils in swales and shallow soils on escarpments and rises. These included soils make up about 5 to 25 percent of the unit. The Daglum soils have a dense, alkali subsoil.

Permeability is moderate in the Watrous soil. It is moderate in the upper part of the Felor soil and slow in the lower part. Runoff is medium on both soils. Available water capacity is low in the Watrous soil and high in the Felor soil. The organic matter content is high in the Watrous soil and moderate in the Felor soil. Tilth is good. The limestone in the Watrous soil restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. These soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and sweetclover are suitable hay and pasture plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion.

These soils are suited to nearly all of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are suited to buildings and are poorly suited to septic tank absorption fields. If buildings are constructed on these soils, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The depth to bedrock in the Watrous soil is a limitation for buildings with basements. This limitation is difficult to overcome because the bedrock is hard and difficult to excavate. The effluent from septic tank absorption fields may follow the bedrock surface or fissures in the Watrous soil and surface downslope or pollute ground water. Using a mound system helps to prevent this pollution. Slow permeability of the Felor soil is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field or by using a mound system.

The land capability classification of both soils is IIe. The range site of both soils is Silty. The productivity index of the unit for spring wheat is 64.

50B—Yegen fine sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on flats and rises on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex or plane and are long and smooth. Individual areas are irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil is about 20 inches thick. It is brown clay loam in the upper part and olive yellow loam in the lower part. The substratum to a depth of about 60 inches is fine sandy loam. It is light brownish gray in the upper part and light gray in the

lower part. In some places the surface layer is loam. In other places the soil is fine sandy loam throughout. In a few places soft bedrock is at a depth of 20 to 40 inches. In a few areas the dark color of the surface layer extends to a depth of more than 16 inches.

Included with this soil in mapping are small areas of Arnegard, Beisigl, Belfield, and Ekalaka soils. These soils make up about 10 to 20 percent of the unit. The Arnegard soils have a loam subsoil. They are in swales. The Beisigl soils are moderately deep. They are on knobs and ridges. The Belfield and Ekalaka soils have an alkali subsoil. They are in swales. Also included are some areas of moderately sloping soils.

Permeability is moderate in the Yegen soil. Runoff is slow. Available water capacity and the organic matter content are moderate. Tilth is good.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or range. This soil is suited to spring-seeded small grain and sunflowers and is well suited to fall-seeded small grain and to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main concerns in managing cultivated areas are controlling soil blowing, maintaining tilth, and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, and minimizing summer fallow help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are western wheatgrass and needleandthread. Western wheatgrass, meadow bromegrass, and sweetclover are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to prevent denuding, control soil blowing, and overcome droughtiness.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is somewhat droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect seedlings from abrasion.

This soil is suited to buildings and septic tank absorption fields. If buildings are constructed on this soil, the shrink-swell potential is a limitation. Installing a surface and foundation drainage system and reinforcing foundations and basement walls help to prevent structural damage caused by shrinking and swelling. The moderate permeability is a limitation in septic tank absorption fields, but it can be overcome by enlarging the field.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 69.

52B—Parshall fine sandy loam, terrace, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on terraces. Most areas are crossed by shallow drainageways. Slopes are plane, long, and smooth. Individual areas are irregular in shape and range from about 50 to 200 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 44 inches thick. It is dark brown loam in the upper part, brown fine sandy loam in the next part, and light brownish gray fine sandy loam in the lower part. The substratum to a depth of about 60 inches is grayish brown fine sandy loam. In some places the dark color of the surface soil extends to a depth of 16 inches. In other places the lower part of the substratum is gravelly sand or loamy fine sand. In a few places the surface layer and subsoil are loam or loamy fine sand.

Included with this soil in mapping are small areas of Amor, Belfield, and Vebar soils. These soils make up about 1 to 15 percent of the unit. The Amor and Vebar soils are moderately deep. They are on slight rises. The Belfield soils have an alkali subsoil. They are in swales.

Permeability is moderately rapid in the Parshall soil. Runoff is slow. Available water capacity is moderate. The organic matter content is high. Tilth is good.

Most areas of this soil are used for cultivated crops. The soil is suited to spring-seeded small grain and sunflowers and is well suited to fall-seeded small grain and to grasses and legumes. The hazard of soil blowing is severe, and that of water erosion is slight. The main

concerns in managing cultivated areas are controlling soil blowing and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, and minimizing summer fallow help to control soil blowing. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface or adding organic material into the plow layer helps to improve fertility, maintain tilth, and increase available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain help to overcome droughtiness.

In areas where this soil is used as range, the important forage plants are needleandthread and prairie sandreed. Crested wheatgrass, prairie sandreed, and sweetclover are suitable hay and pasture plants. Soil blowing and droughtiness are hazards, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable forage plants at a height that traps snow helps to control soil blowing and overcome droughtiness.

This soil is suited to many of the climatically adapted trees and shrubs grown as windbreaks and environmental plantings. It is somewhat droughty, and the trees and shrubs on it commonly are affected by moisture stress. Irrigation or supplemental watering helps to ensure survival of seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity is moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings. Planting strips of an annual cover crop between the rows of trees and shrubs helps to control soil blowing and protect the seedlings from abrasion.

This soil is well suited to buildings and septic tank absorption fields.

The land capability classification is IIIe. The range site is Sandy. The productivity index for spring wheat is 64.

53B—Lehr-Bowdle loams, 1 to 6 percent slopes. These deep, nearly level and gently sloping soils are on terraces. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. The Lehr soil is somewhat excessively drained, and the Bowdle soil is well drained. Slopes are plane or convex and are long and smooth. Individual areas are irregular in shape and range from about 10 to 100 acres in size. They are about 50 to 70 percent Lehr soil and 25 to 45 percent Bowdle soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Lehr soil has a brown loam surface layer about 5 inches thick. The subsoil is about 10 inches thick. It is grayish brown loam in the upper part and brown clay loam in the lower part. The substratum extends to a depth of about 60 inches. It is pale brown gravelly loamy sand in the upper part and light olive brown and light yellowish brown very gravelly loamy sand in the lower part. In a few places the surface layer and subsoil are fine sandy loam. In some places the substratum is gravelly loam.

Typically, the Bowdle soil has a dark grayish brown loam surface layer about 6 inches thick. The subsoil is brown loam about 22 inches thick. The substratum to a depth of about 60 inches is light yellowish brown very gravelly sand. In some places the dark color of the surface layer extends to a depth of 8 to 16 inches. In a few places the surface layer and subsoil are fine sandy loam. In other places the substratum is gravelly loam.

Included with these soils in mapping are small areas of Amor, Parshall, and Shambo soils. These included soils make up about 1 to 10 percent of the unit. The Amor soils are moderately deep. They are on slight rises. The Parshall and Shambo soils have a nongravelly substratum. They are in swales.

Permeability is moderately rapid in the upper part of the Lehr soil and very rapid in the lower part. It is moderate in the upper part of the Bowdle soil and rapid in the lower part. Runoff is medium on both soils. Available water capacity is low in the Lehr soil and moderate in the Bowdle soil. The organic matter content is moderate in the Lehr soil and high in the Bowdle soil. Tilth is good. The substratum in both soils restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. The soils are suited to small grain and sunflowers and are well suited to grasses and legumes. The hazard of soil blowing is slight, and that of water erosion is moderate. The main concerns in managing cultivated areas are controlling water erosion and overcoming droughtiness. Applying a system of conservation tillage that includes leaving crop residue on the surface, minimizing summer fallow, using contour stripcropping, and maintaining grassed waterways in areas where runoff concentrates help to control water erosion. Conservation tillage also provides food and cover for wildlife. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase

available water capacity. Using plants as barriers to trap snow, using conservation tillage to improve the rate of water infiltration, and growing fall-seeded small grain to take advantage of moisture available early in the season help to overcome droughtiness.

In areas where these soils are used as range, the important forage plants are needleandthread and western wheatgrass. Crested wheatgrass, western wheatgrass, and sweetclover are suitable pasture and hay plants. Water erosion is a hazard, especially if the range or pasture is overgrazed. Maintaining an adequate cover of the important or suitable forage plants helps to control water erosion.

The Lehr and Bowdle soils are suited to some of the trees and shrubs grown as windbreaks and environmental plantings. These soils are droughty, and the trees and shrubs on them commonly are affected by moisture stress. Irrigation or supplemental water helps to ensure survival of the seedlings. Little benefit is derived from fallowing the season prior to planting because the available water capacity in these soils is low or moderate. Eliminating grasses and weeds before the trees and shrubs are planted and then controlling the regrowth of this ground cover improve the survival and growth rates of the seedlings.

These soils are well suited to buildings and are poorly suited to septic tank absorption fields. They readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. Using a mound system helps to prevent this pollution. The sides of shallow excavations, such as those of basements, tend to cave in unless they are shored.

The land capability classification of both soils is IIIe. The range site of the Lehr soil is Shallow to Gravel, and that of the Bowdle soil is Silty. The productivity index of the unit for spring wheat is 50.

54—Belfield-Daglum clay loams, saline, 1 to 3 percent slopes. These deep, nearly level, well drained and moderately well drained, alkali, moderately saline soils are in swales and on broad flats on uplands and terraces. Most areas are crossed by shallow drainageways, but in some places the drainageways are indistinct. In areas of native grass, slopes generally are concave or plane and are moderately long and smooth. The surface has a characteristic microrelief. The Belfield soil is on micromounds, and the Daglum soil is in microdepressions. This microrelief is destroyed by cultivation. Individual areas are irregular in shape and range from about 10 to 300 acres in size. They are about 50 to 60 percent Belfield soil and 35 to 45 percent Daglum soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Belfield soil has a surface layer about 8 inches thick. It is grayish brown. It is clay loam in the upper part and silty clay loam in the lower part. It has flecks of salt. The next layer is about 5 inches thick. It is grayish brown silty clay loam that has light brownish gray coatings. The subsoil is silty clay about 41 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The substratum to a depth of about 60 inches is light brownish gray clay loam. In some places the surface layer is silt loam, loam, silty clay loam, or silty clay. In other areas the surface layer and subsoil are calcareous. In a few places the surface layer is lighter colored. In some areas the soil is nonalkali.

Typically, the Daglum soil has a grayish brown clay loam surface layer about 7 inches thick. It has flecks of salt. The subsoil is about 25 inches thick. In sequence downward, it is brown clay, grayish brown clay, grayish brown silty clay, and light brownish gray silty clay loam. The substratum to a depth of about 60 inches is silty clay loam. It is light olive gray in the upper part and light brownish gray and mottled in the lower part. In some places the surface layer is silt loam, loam, or silty clay loam. In other places the surface layer is lighter colored; it has been mixed with the subsoil by tillage. In a few places the subsoil is at a depth of 2 to 5 inches.

Included with these soils in mapping are small areas of Grail and Regent soils. These included soils make up about 5 to 15 percent of the unit. They are nonalkali. The Grail soils occur as areas intermingled with areas of the Belfield and Daglum soils. The Regent soils are on rises. Also included are a few small areas that are nonsaline and some strongly saline areas that have a salt crust on the surface. Some areas of gently sloping soils are also included.

Permeability is slow in the Belfield soil and very slow in the Daglum soil. Runoff is slow on both soils. These soils receive runoff and seepage from adjacent soils. Available water capacity is moderate in the Belfield soil and low in the Daglum soil. The organic matter content is high in the Belfield soil and moderate in the Daglum soil. The salts in both soils limit the amount of water available to plants. A seasonal high water table is at a depth of 3 to 6 feet. Tilth is fair. The dense, alkali subsoil in the Daglum soil restricts the depth to which plant roots can penetrate.

Most areas of these soils are used for cultivated crops. Some areas are used for hay, pasture, or range. These soils are poorly suited to small grain and

sunflowers and to grasses and legumes because of salinity and wetness. They are best suited to range. In years of above average precipitation, seeding is sometimes delayed and occasionally prevented. Areas used for cultivated crops become more saline, because the salts tend to move to the surface when the soil is bare. The hazards of soil blowing and water erosion are slight. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are overcoming salinity and controlling occasional wetness. Applying a conservation tillage system that includes leaving crop residue on the surface and minimizing summer fallow help to control erosion. Conservation tillage also traps snow, which helps to leach salts from the surface layer, and it provides food and cover for wildlife. Continuous cropping and growing deep-rooted, salt-tolerant crops help to control wetness and salinity. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where these soils are used as range, the important forage plants are western wheatgrass and slender wheatgrass. Western wheatgrass, tall wheatgrass, and sweetclover are suitable hay and pasture plants. The high salt content, limited available water capacity, and the dense subsoil in the Daglum soil are problems, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable, salt-tolerant forage plants helps to prevent salt build-up in the surface layer. Stock water reservoirs constructed in areas of these soils frequently contain salty water.

These soils are suited to only a few of the most salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Individual trees and shrubs on these soils vary in height, density, and vigor. They are affected by the salts in the soils. Reducing the evaporation rate at the surface improves seedling survival. When the bare surface dries, salt-laden water tends to move to the surface.

These soils are poorly suited to buildings and septic tank absorption fields because of wetness and the shrink-swell potential. Areas of these soils are avoided for these uses.

The land capability classification of the Belfield soil is IIIs, and that of the Daglum soil is IVs. The range site of both soils is Saline Lowland. The productivity index of the unit for spring wheat is 33.

55B—Moreau silty clay, saline, 1 to 6 percent slopes. This moderately deep, nearly level and gently sloping, well drained and moderately well drained, moderately saline soil is on rises and flats on uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are convex, moderately long, and smooth. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is grayish brown silty clay about 4 inches thick. It has flecks of salt. The subsoil is about 31 inches thick. In sequence downward, it is light brownish gray silty clay, pale olive silty clay, and light olive gray and pale olive channery silty clay. Below this is light olive gray and gray, soft shale. In some places the surface layer is dark grayish brown. In other places the surface layer is noncalcareous. In a few places the surface layer is silty clay loam. In some areas the depth to soft shale is more than 40 inches.

Included with this soil in mapping are small areas of Daglum, Savage, and Wayden soils. These soils make up about 10 to 25 percent of the unit. The Daglum and Savage soils are deep. They are in swales. The Wayden soils are shallow. They are on knobs and ridges. Also included are a few areas of soils that are nonsaline and a few areas of strongly saline soils that have a salt crust on the surface.

Permeability is slow in the Moreau soil. Runoff is medium. This soil receives runoff and seepage from adjacent soils. Available water capacity is very low. The organic matter content is moderate. The salts in the soil limit the amount of water available to plants. A seasonal high water table is at a depth of 3 to 6 feet. Tilth is poor. The shale restricts the depth to which plant roots can penetrate.

Most areas of this soil are used for cultivated crops. Some areas are used as range or hay. Because of salinity and wetness, this soil is poorly suited to small grain and sunflowers and to grasses and legumes. It is best suited to use as range. The hazards of soil blowing and water erosion are moderate. In years of above average precipitation, seeding is sometimes delayed and occasionally prevented. Areas used for cultivated crops generally become more saline, because the salts tend to move to the surface when the soil is bare. The main concerns in managing cultivated areas are controlling salinity, wetness, soil blowing, and water erosion. Applying a conservation tillage system that includes leaving crop residue on the surface, establishing windbreaks, stripcropping, maintaining grassed waterways in areas where runoff concentrates,

and minimizing summer fallow help to control soil blowing and water erosion. Conservation tillage also traps snow, which helps to leach salts from the surface layer, and it provides food and cover for wildlife. Continuous cropping and growing deep-rooted, salt-tolerant crops help to control wetness and salinity. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain or improve tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass, inland saltgrass, and prairie cordgrass. Western wheatgrass, tall wheatgrass, and altai wildrye are suitable hay and pasture plants. The high salt content, soil blowing, and water erosion are concerns, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable, salt-tolerant forage plants helps to prevent salt build-up in the surface layer and to control soil blowing and water erosion. Stock water reservoirs constructed in areas of this soil frequently contain salty water.

This soil is suited to only a few of the most salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Individual trees and shrubs vary in height, density, and vigor. They are affected by the limited amount of water available to plants because of the salts in the soil. Reducing the evaporation rate at the surface improves seedling survival. When the bare surface dries, salt-laden water tends to move to the surface.

This soil is poorly suited to buildings and septic tank absorption fields because of wetness and the shrink-swell potential. Areas of this soil generally are avoided for these uses.

The land capability classification is IIIs. The range site is Saline Lowland. The productivity index for spring wheat is 32.

56—Parshall loam, saline, 1 to 3 percent slopes. This deep, nearly level, well drained and moderately well drained, moderately saline soil is in swales on uplands and terraces. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. Slopes are concave, moderately long, and smooth. Individual areas are irregular or linear in shape and range from about 10 to 100 acres in size.

Typically, the surface soil is very dark gray loam about 14 inches thick. It has flecks of salt. The subsoil is fine sandy loam about 25 inches thick. It is very dark gray in the upper part and brown in the lower part. The substratum to a depth of about 60 inches is olive brown, mottled loam. In some places the dark color of the surface soil extends to a depth of only 7 inches or to as much as 16 inches. In other places the lower part of the substratum is gravelly or loamy fine sand. In a few places the soil is loam or fine sandy loam throughout. In a few areas soft bedrock is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Belfield, Regan, and Vebar soils. These soils make up about 15 to 25 percent of the unit. The Belfield soils have an alkali subsoil. The Regan soils are poorly drained. These soils are adjacent to drainageways. The Vebar soils are moderately deep. They are on side slopes and slight rises. Also included are a few areas of soils that are nonsaline and a few areas of strongly saline soils that have a salt crust on the surface. Some areas of gently sloping soils are also included.

Permeability is moderately rapid in the Parshall soil. Runoff is slow. The soil receives runoff and seepage from adjacent soils. Available water capacity is low. The organic matter content is high. The salts in the soil limit the amount of water available to plants. A seasonal high water table is at a depth of 3 to 6 feet. Tilth is good.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or range. Because of salinity and wetness, this soil is poorly suited to small grain and sunflowers and to grasses and legumes. It is well suited to range. The hazards of soil blowing and water erosion are slight. In years of above average precipitation, seeding is sometimes delayed and occasionally prevented. Areas used for cultivated crops generally become more saline, because the salts tend to move to the surface when the soil is bare. The main concerns in managing cultivated areas are controlling salinity and wetness. Applying a conservation tillage system that includes leaving crop residue on the surface, minimizing summer fallow, and stripcropping help to control erosion. Conservation tillage also traps snow, which helps to leach salts from the surface layer, and it provides food and cover for wildlife. Continuous cropping and growing deep-rooted, salt-tolerant crops help to control wetness and salinity. Using crop residue on the surface and adding organic material into the plow layer help to improve fertility, maintain tilth, and increase the rate of water infiltration.

In areas where this soil is used as range, the important forage plants are western wheatgrass and slender wheatgrass. Western wheatgrass, tall wheatgrass, and sweetclover are suitable hay and pasture plants. The high salt content and limited available water capacity are problems, especially if the

range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable, salt-tolerant forage plants helps to prevent salt build-up in the surface layer. Stock water reservoirs constructed in areas of this soil frequently contain salty water.

This soil is suited to only a few of the most salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. Individual trees and shrubs vary in height, density, and vigor. They are affected by the limited amount of water available to plants because of the salts in the soil. Reducing the evaporation rate at the surface improves seedling survival. When the bare surface dries, salt-laden water tends to move to the surface.

This soil is poorly suited to buildings and septic tank absorption fields because of wetness. Areas of this soil generally are avoided for these uses.

The land capability classification is IIIs. The range site is Saline Lowland. The productivity index for spring wheat is 35.

57—Daglum-Rhoades loams, saline, 1 to 3 percent slopes. These deep, nearly level, well drained and moderately well drained, alkali, moderately saline soils are on terraces and uplands. Most areas are crossed by shallow drainageways, but in places drainageways are moderately deep. In areas of native grass, slopes are convex or plane and are long and uneven. The surface has a characteristic microrelief. The Daglum soil is on micromounds, and the Rhoades soil is in microdepressions. This microrelief is destroyed by cultivation. Barren scab spots also are characteristic of areas of these soils. Individual areas are irregular in shape and range from about 10 to 200 acres in size. They are about 40 to 65 percent Daglum soil and 35 to 60 percent Rhoades soil. The two soils occur as areas so intricately intermingled or so small that mapping them separately is not practical.

Typically, the Daglum soil has a dark grayish brown loam surface layer about 5 inches thick. It has flecks of salt. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is clay about 21 inches thick. It is brown in the upper part, light gray in the next part, and pale olive in the lower part. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam. In some places the surface layer is silt loam, silty clay loam, silty clay, or clay loam. In other places the surface layer and subsoil are calcareous. In a few places soft siltstone or shale is at a depth of 40 to 60 inches.

Typically, the Rhoades soil has a grayish brown loam surface layer about 2 inches thick. It has flecks of salt. The subsoil is about 52 inches thick. In sequence downward, it is grayish brown clay, light yellowish brown clay loam, pale yellow silty clay, and light gray silty clay. Below this is light gray, soft shale. In some places the surface layer is clay loam, silty clay loam, or silty clay. In a few places soft shale is at a depth of more than 60 inches.

Included with these soils in mapping are small areas of Belfield, Ekalaka, Harriet, and Moreau soils. These included soils make up about 5 to 15 percent of the unit. The Belfield soils do not have columnar structure in the upper part of the subsoil. They occur as areas intermingled with areas of the Daglum and Rhoades soils. The Ekalaka soils are fine sandy loam throughout. They are on slight rises. The Harriet soils are poorly drained. They are in drainageways. The Moreau soils are moderately deep. They are on slight rises. Also included are a few small areas of soils that are nonsaline and some areas of strongly saline soils that have a salt crust on the surface. Some areas of gently sloping soils are also included.

Permeability is very slow in both soils. Runoff is slow on both soils. These soils receive runoff and seepage from adjacent soils. Available water capacity is low in both soils. The organic matter content is moderate in both soils. The salts in both soils limit the amount of water available to plants. A seasonal high water table is at a depth of 3 to 6 feet. Tilth is poor. The dense, alkali subsoil in both soils restricts the depth to which plant roots can penetrate.

Most areas of these soils are used as range. Some areas are used for cultivated crops, hay, or pasture. These soils are poorly suited to small grain and sunflowers and to grasses and legumes because of salinity, wetness, and the dense, alkali subsoil. They are best suited to range. The hazards of soil blowing and water erosion are slight. During periods of moisture stress, small grain has an uneven appearance because the plants vary in height on the two soils. The main concerns in managing cultivated areas are overcoming salinity and controlling occasional wetness. Applying a conservation tillage system that includes leaving crop residue on the surface, minimizing summer fallow, maintaining grassed waterways in areas where runoff concentrates, and constructing terraces help to control localized soil erosion. Conservation tillage also traps snow, which helps to leach salts from the surface layer, and it provides food and cover for wildlife. Continuous cropping and growing deep-rooted, salt-tolerant crops help to control wetness and salinity. Using crop residue on the surface and adding organic material into the

plow layer help to improve fertility and maintain or improve tilth and increase the rate of water infiltration.

In areas where these soils are used as range, the important forage plants are western wheatgrass and slender wheatgrass. Western wheatgrass, tall wheatgrass, and sweetclover are suitable hay and pasture plants. The high salt content, limited available water capacity, and dense subsoil in these soils are problems, especially if the range or pasture is overgrazed. Reestablishing vegetation is difficult in denuded areas. Maintaining an adequate cover of the important or suitable, salt-tolerant forage plants at a height that traps snow helps to prevent denuding and control salt build-up in the surface layer. Stock water reservoirs constructed in areas of these soils frequently contain salty water.

The Daglum soil is suited to only a few of the most salt-tolerant, climatically adapted trees and shrubs grown as windbreaks and environmental plantings. The Rhoades soil generally is unsuited to trees and shrubs. Individual trees and shrubs on these soils vary in height, density, and vigor. They are affected by the salts in the soils and the dense, alkali subsoil. Reducing the evaporation rate at the surface improves seedling survival. When the bare surface dries, salt-laden water tends to move to the surface.

These soils are poorly suited to buildings and septic tank absorption fields because of wetness and shrink-swell potential. Areas of these soils generally are avoided for these uses.

The land capability classification of the Daglum soil is IVs, and that of the Rhoades soil is VIs. The range site of both soils is Saline Lowland. The productivity index of the unit for spring wheat is 16.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 16,000 acres, or about 2 percent, of the county meets the requirements for prime farmland.

The map units in the survey area that are considered prime farmland are listed at the end of this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

The map units that meet the requirements for prime farmland are:

4	Grail clay loam, 1 to 3 percent slopes
15	Arnegard loam, 1 to 3 percent slopes
24	Straw loam, 0 to 3 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

By Lyle Samson, agronomist, and Clifford E. Jeske, soil conservationist, Soil Conservation Service.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 80 percent of Hettinger County is cultivated. In 1983, 230,700 acres was used for close-grown crops, 68,100 acres for row crops, and 49,000 acres for forage crops *(12)*. During the period 1980 to 1985, the acreage used for close-grown crops averaged 270,200 acres per year. The acreage of summer fallow was 180,000 in 1982, 200,000 in 1983, and 165,000 in 1984. The acreage used for sunflowers is increasing. It averaged 64,000 acres per year from 1980 to 1985. The acreage used to produce corn for silage and forage has been stable in recent years. The acreage of corn for grain has increased. In 1984 the acreages of the principal close-grown crops were as follows: spring wheat, 170,000 acres; durum wheat, 24,000 acres; winter wheat, 11,000 acres; barley, 38,000 acres; oats, 21,000 acres; rye, 6,300 acres; and flax, 1,700 acres. The main row crops were sunflowers and corn. Sunflowers were grown on 79,000 acres, corn for grain on 7,500 acres, and corn for silage on 5,100 acres. Alfalfa was grown

on 34,000 acres and other hay crops on 13,000 acres. Small acreages were planted to mustard, buckwheat, sorghum, millet, soybeans, and safflowers.

The potential of the soils in Hettinger County for increased production of food and fiber is good. This production is steadily increasing as the latest crop production technology is applied. This soil survey can facilitate the application of this technology.

The soils and climate of the county are suited to most of the crops that are commonly grown. Crops that are not commonly grown but are suitable include potatoes and rapeseed.

The principal management measures that help to ensure continuing productivity are those that control soil blowing and water erosion, maintain or improve fertility and tilth, and result in proper use of soil moisture.

Water erosion and soil blowing reduce the productivity of the soils. If the surface layer is lost, most of the available plant nutrients also are lost. As a result, applications of fertilizer are needed to maintain adequate crop production.

Of equal concern is the loss of organic matter through erosion. Soil structure, water infiltration, available water capacity, and tilth are all negatively affected by this loss. As organic matter is lost and the subsoil is exposed and tilled, the remaining soil becomes more susceptible to both soil blowing and water erosion.

Soil blowing is a hazard on most of the soils in Hettinger County. It is a severe hazard on the coarse textured and moderately coarse textured soils, including Beisigl, Ekalaka, Flasher, Lefor, Lihen, Parshall, Ruso, Vebar, Velva, and Yegen soils.

Cabba, Chama, Moreau, Regan, and other soils that have a relatively high content of lime are susceptible to soil blowing in spring if they have been bare throughout winter. Freezing and thawing cause soil structure to break down, which produces aggregates that are susceptible to movement. Nearly all soils can be damaged by soil blowing if they are bare.

Water erosion is a severe hazard on the moderately sloping and steeper soils, such as Amor, Cabba, Chama, and Regent soils. It also is a severe hazard on Savage and other soils that have long, gentle slopes. The hazard is greatest when the surface is bare.

Conservation practices that control both soil blowing and water erosion are those that maintain a protective cover on the surface (fig. 9). Examples are conservation tillage systems that keep a protective amount of crop residue on the surface. Applications of herbicides can help to eliminate the need for summer fallow tillage. Cover crops are also effective in controlling both soil blowing and water erosion. Establishing field windbreaks and wind barriers and stripcropping help to control soil blowing. The benefit of stripcropping is increased when the strips are oriented northeast to southwest. This orientation places the strips at right angles to the prevailing northwest wind. Hettinger County leads the state of North Dakota in installing this effective type of stripcropping. Including grasses and legumes in the cropping sequence; installing grassed waterways, diversions, and terraces; contour farming; and field stripcropping across the slope help to control water erosion. Using a management system that includes several measures is the best means of protecting the soil. For example, conservation tillage can control soil blowing during years when the amount of crop residue is adequate, but windbreaks are needed during years when the amount of residue is low.

Availability of moisture at planting time is critical to the success of the crop during the growing season. In years when the amount of available soil moisture is low at planting time, crop production for the year is greatly reduced. Measures that reduce evaporation and runoff rates, increase the rate of water infiltration, and control weeds conserve moisture. Examples of such measures are stubble mulch tillage; no-till farming; stripcropping; growing cover crops; crop residue management; letting stubble stand, which traps snow; and applying fertilizer. When fallow is used to conserve moisture for the next season, a cover of crop residue is essential during winter to guard against moisture loss and erosion. Weed control helps to prevent depletion of the moisture supply.

Measures that improve fertility are needed on many soils. Examples of such measures are applying commercial fertilizer, growing green manure crops, including legumes in the cropping system, and using barnyard manure.

Proper management of soils includes measures that maintain good tilth. These measures are especially needed on soils that have a surface layer of silty clay loam, clay loam, or silty clay. Dimmick, Grail, Heil, Lawther, Moreau, Regent, and Savage soils are examples. Measures that maintain the content of organic matter are very important if good tilth is to be maintained. The traditional practice of clean-tilled summer fallow contributes to the loss of organic matter because it increases the susceptibility of the soil to erosion.

Management of Saline and Alkali Soils

Saline and alkali soils make up about 19 percent of

Figure 9.—Stripcropping helps to protect the soils from soil blowing. Areas unsuited to cultivation are in native grass.

Hettinger County. Saline soils make up 1.5 percent of the county, or about 11,360 acres; alkali soils make up 13 percent, or about 94,410 acres; and saline-alkali soils make up 4.3 percent, or about 30,900 acres. Soils affected by saline seeps make up about 18,000 acres, or 2.5 percent, of the county. These soils are Belfield-Daglum clay loams, saline, 1 to 3 percent slopes; Belfield-Grail clay loams, saline, 0 to 3 percent slopes; Daglum-Rhoades loams, saline, 1 to 3 percent slopes; Moreau silty clay, saline, 1 to 6 percent slopes; and Parshall loam, saline, 1 to 3 percent slopes. In addition, there are small areas, generally about 0.3 to 0.5 acre, of soils affected by saline seeps. These areas are identified by a spot symbol on the detailed soil maps.

Saline soils have a high concentration of soluble salts. Saline seeps are areas of nonirrigated soils where salinity has recently developed. They are basically low-volume springs. The term "saline seep" distinguishes these recently developed saline soils from residual saline soils of preagricultural origin. A local term for saline soils is "white alkali."

Saline seeps generally develop in areas of restricted drainage. Where drainage is poor, salts rise with the water table and are concentrated near the surface. This salt buildup is reduced by maintaining a surface cover of plants. The plant roots use the soil water before it can reach the surface and before the salts accumulate. The plant cover prevents evaporation at the surface, upward movement of water in the soil, and the concentration of salts at the surface. Residual saline soils, such as Regan loam, generally form in areas adjacent to natural sloughs and waterways. Saline seeps, on the other hand, commonly develop on the upper slopes. Typically, they develop when water moves through the soil and dissolves salts. The salt-laden water that is not used by crops moves downward through the soil until it reaches an impermeable layer that impedes its progress. It then flows laterally until it discharges in areas where the water table is at or near the surface. As a result, salts are concentrated at or near the surface.

Plants growing on saline soils absorb salts from the water in the soil. Excess amounts of certain salts may interfere with plant growth. High concentrations of some

salts are toxic to certain plants. Some salts cause nutritional imbalances or deficiencies by restricting the uptake or availability of certain plant nutrients. Detecting salinity by visual observations in the field is difficult. The salts generally are not visible during much of the growing season, particularly when the soil is moist. Flecks, threads, or masses of soluble salts commonly are visible when the soil is dry. Laboratory analysis is needed to determine the actual degree of salinity in soils.

Crop response, particularly during periods of soil moisture stress, is a useful indicator of the degree of salinity in soils. For instance, small grain on saline soils tends to be stunted and has fewer tillers than small grain on nonsaline soils. Strongly saline soils are best suited to native grasses or to salt-tolerant, introduced grasses. Slightly saline or moderately saline soils can be used for salt-tolerant crops and forage plants. Barley is the most salt-tolerant of the small grain crops. Of the forage plants, beardless wildrye, slender wheatgrass, tall wheatgrass, western wheatgrass, and alfalfa are salt-tolerant once they are established.

Saline seeps can be controlled by measures that reduce or prevent the flow of water in the soil from the contributing area to the seep area. The best measures are growing deep-rooted crops, such as alfalfa and sunflowers, and eliminating or reducing fallow in the contributing area. The extent of summer fallow can be reduced by using a "flex-cropping" system, in which planting decisions are based on the amount of moisture stored in the soil. If the amount is adequate at planting time, a crop is planted. Thus the land is fallowed only in years when the amount of moisture is inadequate at planting time. Barriers that trap snow increase the supply of soil moisture at planting time in spring and thus help to eliminate the need for fallow. Drainage of saline seeps generally is not feasible in Hettinger County, because disposal of the salty water is a problem.

Alkali soils are characterized by a high content of exchangeable sodium, which adheres to the clay particles in the soil. The alkali soils in Hettinger County are Belfield clay loam, Daglum loam and clay loam, Ekalaka fine sandy loam, and Rhoades loam. Locally, alkali soils are known as "black-alkali," "slick spots," "pan spots," or "gumbo."

Alkali soils develop in a complex pattern with a very distinct microrelief. The physical and chemical properties of these soils differ markedly within very short distances. In many areas the distance between the alkali soils and the surrounding soils that have normal physical properties is only about 5 to 10 feet.

Alkali soils develop in areas of saline soils that contain large quantities of sodium salts. Over a long period, usually centuries, as the water table drops, rain gradually leaches the salts from the surface layer to the lower horizons. During this leaching process, the clay in the soil becomes saturated with sodium, disperses, and moves downward with the percolating water. As the moving clay concentrates, a dense, alkali subsoil forms. The dense subsoil is hard when dry, sticky when wet, and nearly impervious to roots, water, and air. Examples of soils that have a dense, alkali subsoil are the Daglum and Rhoades loams.

As leaching by soil water continues, the sodium is gradually removed from the clay particles. The result is a more manageable soil, such as the Belfield clay loam. If the leaching process continues and nearly all of the sodium is removed from the profile, the soil eventually changes into a nonalkali soil, such as the Grail clay loam or the Savage clay loam. This change requires a long period, usually centuries *(7)*.

If plowed, alkali soils are characterized by a surface layer that is sticky when wet and hard and cloddy when dry. A crust forms easily at the surface. The chemical and physical properties of these soils are unfavorable for plant growth. The harmful effects of the properties on plants generally increase as the sodium content increases. The effects of the reduced amount of water available to plants are more harmful than the toxic effects of the sodium. The plants also are affected by the depth to the dense subsoil.

Identification of alkali soils in cultivated fields commonly is difficult because many of the physical characteristics, such as columnar structure, have been altered by tillage. Crop response, particularly during periods of soil moisture stress, is a useful indicator of the level of alkalinity in a soil. Crops grown on soils with varying amounts of sodium exhibit varying heights and stages of development. If the level of alkalinity is very high, the crop cannot grow. The effects of sodium on crop growth are influenced by weather conditions, the stage of crop growth, and the soil moisture status. A measure of the effect of alkalinity on plant growth is not necessarily a reliable measure of crop yields. In many areas the yields of barley and wheat are affected less than the growth of these crops.

The variability of alkali soils can cause management problems. The alkali soils that have salts within a depth of 16 inches, such as Rhoades loam, generally are best suited to native grasses. The soils that have a dense, alkali subsoil near the surface generally are unsuited to small grain and sunflowers.

Timely tillage is an important management practice

needed in areas of leached alkali soils, such as the Belfield clay loam. These areas should be tilled and seeded only when the moisture content is favorable. If the soil is worked when too wet, it puddles and crusts. If it is worked when too dry, the tillage and seeding implements cannot easily penetrate the soil. Deep plowing and applying chemical amendments can help to reclaim alkali soils, but use of these practices may not be feasible. To be effective, deep tillage should reach to the alkali subsoil and mix several inches of the underlying material with the subsoil and topsoil. Depending on the soil, tillage to a depth of 15 to 36 inches may be needed. Any reclamation of alkali soils is a long-term endeavor. Complete reclamation may never be achieved. Onsite investigation is needed to confirm the feasibility of deep tillage in a particular area.

Saline-alkali soils develop in areas of restricted drainage, where salts rise with the water table but where some leaching downward of clay and some saturation with sodium are evident and a dense, alkali subsoil has formed. The saline-alkali soils in Hettinger County are Harriet loam; Heil silty clay loam; Belfield-Daglum clay loams, saline, 1 to 3 percent slopes; the Belfield part of Belfield-Grail clay loams, saline, 0 to 3 percent slopes; and Daglum-Rhoades loams, saline, 1 to 6 percent slopes. The saline Belfield, Daglum, and Rhoades soils exhibit a postagricultural reintroduction of a water table and salts into the soil. As a result, they have high salinity and a dense, alkali subsoil. The management needs and crop responses on these soils are a combination of those on saline soils and those on alkali soils.

Additional information about management or reclamation of saline and alkali soils is available from the Soil Conservation Service, the North Dakota Agricultural Experiment Station, and the Cooperative Extension Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Productivity Index

The productivity index is a relative rating of the ability of a particular map unit to produce a particular crop yield in comparison with other map units. The index ranges from 0, which indicates no yield, to 100, which indicates the highest yield. When the index is calculated, the similar and contrasting inclusions are considered as well as the soils specified in the name of the map unit. In Hettinger County a productivity index of 100 was considered equal to an average yield of 31 bushels per acre of spring wheat. Multiplying the productivity index by 31 and then dividing the product by 100 will convert the index number to a figure representing the expected average yield per acre. Shambo loam, 1 to 3 percent slopes, for example, has a productivity index of 84 that, when multiplied by 31 and then divided by 100, converts to 26, which is the expected annual yield of spring wheat in bushels per acre for this map unit (see table 5). The productivity index for each map unit is given in the section "Detailed Soil Map Units."

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for

field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

By Brian D. Gerbig, range conservationist, Soil Conservation Service.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

The native vegetation on rangeland consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. Generally, the plants are suitable for grazing and the plant cover is sufficiently productive to justify grazing. Cultural treatments generally are not used to increase forage production. The composition and production of the plant community are determined by soil, climate, topography, overstory canopy, and grazing management.

In 1984 about 166,000 acres in Hettinger County was used as rangeland. In areas where it is properly managed, this rangeland is similar to the presettlement prairie of the late 1800's and early 1900's. Most of the rangeland consists of soils that have characteristics that limit their use as cropland. For example, the Cabba-Amor-Savage complex, 9 to 70 percent slopes, extremely stony, is suited only to use as rangeland because of the slope, a low or very low available water capacity, rapid runoff, and a severe hazard of erosion. Because of salinity, wetness, and alkalinity, Harriet loam generally is unsuited to uses other than rangeland.

Cow-calf enterprises dominate in the county. A number of ranches also include a yearling enterprise, which adds flexibility during periods of low or high forage production. On some ranches used for a cow-calf enterprise, sheep are raised for improved income stability.

Because of the relatively short growing season, many farmers and ranchers have established about 20,000 acres of cool-season, tame pastures to supplement the forage produced on rangeland and to extend the grazing season in spring and fall. Droughts of short duration are common. As a result, cool-season pastures

cannot be grazed in fall in many years. The farms in Hettinger County had about 31,000 head of cattle in 1985. Hay is grown for livestock on about 50,000 acres each year *(12)*. Generally, large amounts of hay and feed are needed because of the long winters.

Range Sites and Condition Classes

Soils vary in their capacity to produce grasses and other plants suitable for grazing. Soils that produce about the same kinds and amounts of forage are grouped into a range site.

Each range site has a distinctive potential plant community that is referred to as the climax vegetation. The climax vegetation is relatively stable and indicates what the range site is capable of producing. It reproduces itself annually and changes very little as long as the environment remains unchanged. On the prairie the climax vegetation consists of the kinds of plants that grew when the region was settled. It generally is the most productive combination of forage plants that can be grown on the site. When the site is improperly grazed, some of the climax vegetation decreases in proportion and some of it increases. Also, other plants that were not part of the native plant community invade the site.

Decreaser plants are the species that decline in quantity under close, continuous grazing. They generally are the tallest and most productive grasses and forbs and are the most palatable to livestock.

Increaser plants are the species that increase in quantity under close grazing at the expense of the decreaser species. They generally are the shorter plants or the ones less palatable to livestock.

Invader plants are species normally not included in the climax plant community because they cannot compete with the climax vegetation for moisture, nutrients, and light. They invade the site only after the extent of the climax vegetation has been reduced by heavy, continual grazing. Most invader species have little value for grazing.

Range condition classes indicate the present composition of the plant community on a range site in relation to the climax vegetation. Range condition is expressed as excellent, good, fair, or poor, depending on how much the present plant community resembles the natural plant community. *Excellent* indicates that 76 to 100 percent of the present plant community is the same as the climax vegetation; *good*, 51 to 75 percent; *fair*, 26 to 50 percent; and *poor*, 25 percent or less.

Potential forage production depends on the kind of range site. Current forage production depends on the range condition and the amount of moisture available to the plants during the growing season.

Table 6 shows, for each soil in the county, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as kind of plant, stage of growth, exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural

plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Good range management keeps the range in excellent or good condition. Water is conserved, yields are improved, and soils are protected. The main management concern is recognizing the changes in the plant community that take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall, for example, may lead to the conclusion that the range is in good condition, when actually the plant cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been grazed closely for a short period may have a degraded appearance that temporarily obscures its quality and ability to recover rapidly.

Rangeland can recover from prolonged overuse if the decreaser species of the climax plant community have not been completely grazed out. If overgrazing is stopped, enough climax plants generally remain for proper grazing management to restore the rangeland to an excellent condition. In areas where the climax plant community has been destroyed, range seeding can improve the condition. Seeding the proper climax species in areas of poor-quality cropland can restore its productivity as rangeland. Brush control, development of watering facilities, and other mechanical practices are needed to improve the potential of some rangeland. Proper fencing provides the opportunity to achieve good management of rangeland.

The following paragraphs describe the range sites in Hettinger County. The names of these sites are Clayey, Claypan, Closed Depression, Overflow, Saline Lowland, Sands, Sandy, Sandy Claypan, Shallow, Shallow Clay, Shallow to Gravel, Silty, Subirrigated, Thin Claypan, Very Shallow, and Wetland.

Clayey range site. This site is dominated by cool-season grasses. Grasses make up about 80 percent of the vegetation. The major species are western wheatgrass, green needlegrass, blue grama, needleandthread, and prairie junegrass. Upland sedges make up about 5 percent of the vegetation. Forbs, such as scarlet globemallow, prairie coneflower, western yarrow, prairie thermopsis, and gray sagewort, also make up about 5 percent. Fringed sagebrush, western snowberry, and prairie rose are among the shrubs that make up the rest of the vegetation.

Heavy grazing results in a decrease in the abundance of green needlegrass, needleandthread, and prairie junegrass. Western wheatgrass initially increases in abundance but then also becomes a decreaser. The plants that increase in abundance under these conditions are blue grama, upland sedges, Sandberg bluegrass, and fringed sagebrush. Further deterioration results in a dominance of blue grama, upland sedges, and fringed sagebrush.

Very few problems affect the management of this site. The water intake rate is slow. As a result, an adequate cover of vegetation is needed to help ensure that forage production is not reduced by runoff. Areas where the range is in poor or fair condition can generally be restored to good or excellent condition by good management of the remnant climax species.

Claypan range site. The climax vegetation on this site is mainly western wheatgrass, blue grama, green needlegrass, needleandthread, and prairie junegrass. These grasses and small amounts of others make up about 80 percent of the vegetation. Upland sedges make up about 10 percent. Forbs, such as silverleaf scurfpea, rush skeletonplant, and scarlet globemallow, make up about 5 percent. Fringed sagebrush, broom snakeweed, and other shrubs make up the rest.

The principal decreasers are western wheatgrass, green needlegrass, prairie junegrass, and needleandthread. The increasers are blue grama, inland saltgrass, Sandberg bluegrass, upland sedges, and fringed sagebrush. Further deterioration results in a dominance of blue grama, inland saltgrass, upland sedges, fringed sagebrush, and undesirable forbs.

This site is easily damaged by overgrazing. Because of a dense subsoil and the content of salts in the soil, reestablishing the vegetation is difficult in denuded areas. Careful management that maintains the abundance of the key plants is the best way to maintain forage production and protect the soil from water erosion.

Closed Depression range site. The climax vegetation on this site is mainly western wheatgrass, prairie cordgrass, slender wheatgrass, fowl bluegrass, and foxtail barley. These grasses and small amounts of others make up about 80 percent of the vegetation. Common spikesedge makes up about 5 percent. The rest is forbs, such as curled dock, povertyweed, Nuttall cinquefoil, and smartweed.

The principal decreasers are prairie cordgrass, common spikesedge, and slender wheatgrass. The increasers are western wheatgrass, foxtail barley, fowl

bluegrass, inland saltgrass, and needle spikesedge. Further deterioration results in a dominance of fowl bluegrass, foxtail barley, inland saltgrass, curlycup gumweed, and povertyweed.

This site is easily damaged by overgrazing. Livestock are attracted to this site because of the supply of moisture to the vegetation. As a result, the site is frequently overgrazed and damaged by trampling. Using a properly designed grazing system can restore the climax vegetation to its potential.

Overflow range site. The potential plant community on this site is mainly big bluestem, western wheatgrass, green needlegrass, needleandthread, little bluestem, porcupinegrass, and blue grama. These and other grasses make up as much as 80 percent of the vegetation. Pennsylvania sedge, fescue sedge, and other grasslike plants make up about 5 percent. Stiff sunflower, heath aster, prairie coneflower, Missouri goldenrod, and other forbs make up about 10 percent. The rest is western snowberry, juneberry, chokecherry, and other shrubs.

Overgrazing results in a decrease in the abundance of big bluestem, green needlegrass, porcupinegrass, and needleandthread. The plants that readily increase in abundance under these conditions are blue grama, western wheatgrass, Pennsylvania sedge, fescue sedge, and Kentucky bluegrass. If overuse continues, the plant community is dominated by blue grama, Pennsylvania sedge, Kentucky bluegrass, and other low-growing grasses and sedges.

Because of its position on the landscape, this site is frequently overgrazed. Fencing generally is not feasible because of the small size or the shape of areas of this site. As a result of flooding and the runoff received by these areas, this site is very productive when properly managed. Using a planned grazing system can restore the site and maintain a high level of productivity. Reseeding is needed in areas that have been farmed. In areas where shrubs dominate, brush control can help to restore productivity.

Saline Lowland range site. The potential plant community on this site consists of salt-tolerant species. Western wheatgrass, Nuttall alkaligrass, inland saltgrass, slender wheatgrass, foxtail barley, plains bluegrass, alkali cordgrass, and alkali muhly are the principal grasses. Grasses make up approximately 85 percent of the vegetation. Prairie bulrush and other grasslike plants make up about 5 percent. Alkali plantain, silver cinquefoil, Pursh seepweed, dock, and minor amounts of other forbs make up the rest.

Heavy grazing results in a decrease in the abundance of Nuttall alkaligrass, slender wheatgrass, plains bluegrass, alkali cordgrass, and western wheatgrass. Plants that increase in abundance under these conditions are inland saltgrass, foxtail barley, alkali muhly, and mat muhly. If heavy grazing continues, inland saltgrass, foxtail barley, and low-quality forbs, such as Pursh seepweed, western dock, and silver cinquefoil, dominate the site.

A high content of salts and a restricted available water capacity limit forage production on this site. Careful management of the adapted salt-tolerant plants can maintain good forage production. If the plant community has been severely damaged, however, the site recovers slowly. Soil blowing and water erosion are hazards in denuded areas. Stock water ponds on this site frequently contain salty water. If feasible, alternative water sources should be developed.

Sands range site. The climax vegetation on this site is dominated by mid grasses. Needleandthread and prairie sandreed are the principal species. Other grasses are sand bluestem, blue grama, prairie junegrass, and western wheatgrass. Grasses make up about 75 percent of the vegetation. Upland sedges make up about 10 percent. Forbs, such as stiff goldenrod, purple coneflower, hairy goldaster, gray goldenrod, prairie spiderwort, and green sagewort, make up about 15 percent. Woody shrubs, such as leadplant amorpha, prairie rose, western snowberry, and fringed sagebrush, make up the rest.

Overgrazing results in a decrease in the abundance of prairie sandreed, sand bluestem, prairie junegrass, little bluestem, purple prairie-clover, purple coneflower, and leadplant amorpha. Needleandthread initially increases in abundance but then decreases if overgrazing continues. The principal increasers are sand dropseed, blue grama, upland sedges, green sagewort, and fringed sagebrush. Continued heavy grazing results in the dominance of blue grama, upland sedges, green sagewort, and fringed sagebrush, unless soil blowing has affected the site.

A low available water capacity and the hazard of soil blowing are concerns in managing this site. Measures that minimize the formation of livestock trails and that do not allow the animals to concentrate in an area for too long a time are needed. In severely overgrazed areas, blowouts are common. On large blowouts, shaping, seeding, and mulching are needed before the climax vegetation can be reestablished. The vegetation in areas where the site is in fair or poor condition responds rapidly to improved grazing management.

Sandy range site. Grasses make up about 75 percent of the climax vegetation on this site. Needleandthread and prairie sandreed are the principal species. Other grasses are western wheatgrass, green needlegrass, prairie junegrass, and blue grama. Upland sedges make up about 10 percent of the vegetation. Forbs, such as silverleaf scurfpea, goldenrod, western yarrow, prairie spiderwort, and gray sagewort, also make up about 10 percent. Silver sagebrush, prairie rose, leadplant amorpha, and western snowberry make up the rest.

Overgrazing results in a decrease in the abundance of prairie sandreed, green needlegrass, western wheatgrass, prairie junegrass, and leadplant amorpha. Needleandthread initially responds as an increaser and then decreases in abundance if overgrazing continues. The species that increase in abundance are blue grama, upland sedges, sand dropseed, green sagewort, and silver sagebrush. Further deterioration results in an abundance of blue grama, upland sedges, silver sagebrush, green sagewort, and other low-quality forbs.

A low or moderate available water capacity is a concern in managing this site. Also, soil blowing is a hazard in denuded areas. Management that maintains the abundance of the key species results in a natural plant community that provides excellent forage for livestock and a protective plant cover.

Sandy Claypan range site. Short grasses dominate this site. The principal species are western wheatgrass, needleandthread, and blue grama. Other species are sun sedge, other upland sedges, and a small number of perennial forbs. The common woody plants are silver sagebrush, fringed sagebrush, and western snowberry.

Continual heavy grazing results in a decrease in abundance of such plants as western wheatgrass and needleandthread. The plants that increase in abundance under these conditions are blue grama, upland sedges, and fringed sagebrush. Further deterioration results in a dominance of blue grama, upland sedges, fringed sagebrush, annual forbs, and annual grasses.

Forage production varies on this site. The soil has a dense, alkali subsoil and a limited available water capacity. The site is fragile, and the natural plant community can deteriorate rapidly. Management that maintains a protective plant cover is needed to control erosion.

Shallow range site. The principal climax species on this site are little bluestem, needleandthread, western wheatgrass, plains muhly, blue grama, sideoats grama, and prairie sandreed. Grasses make up about 75 percent of the vegetation. Upland sedges make up about 10 percent. Forbs, such as blacksamson, hairy goldaster, skeletonweed, purple prairie-clover, dotted gayfeather, stiff sunflower, and green sagewort, also make up about 10 percent. Shrubs and half-shrubs, such as fringed sagewort, common winterfat, western snowberry, and shrubby cinquefoil, make up the rest.

Heavy grazing results in a decrease in the abundance of little bluestem, needleandthread, sideoats grama, prairie sandreed, blacksamson, purple prairie-clover, stiff sunflower, and dotted gayfeather. Initially western wheatgrass tends to increase in abundance, but then it decreases. Blue grama, upland sedges, red threeawn, green sagewort, and fringed sagewort are increasers. Further deterioration results in a dominance of blue grama, upland sedges, fringed sagewort, green sagewort, and other unpalatable forbs.

Because of a low available water capacity, forage production is limited on this site. Water erosion is a hazard in areas that have a slope of more than 5 percent. Gullies form readily along cattle trails and in denuded areas. Management that maintains the key plants and cross fencing, which helps to control the pattern of livestock traffic, help to maintain productivity. A planned grazing system is an excellent method of restoring productivity if the site has deteriorated.

Shallow Clay range site. The principal climax species on this site are western wheatgrass, green needlegrass, blue grama, plains muhly, and Sandberg bluegrass. These and other grasses make up about 80 percent of the vegetation. Forbs, such as prairie thermopsis, povertyweed, wooly Indianwheat, and rush skeletonplant, make up about 10 percent. Shrubs and half-shrubs, such as fringed sagebrush, broom snakeweed, big sagebrush, and Nuttall saltbush, make up the rest.

Heavy grazing results in a decrease in the abundance of western wheatgrass, green needlegrass, plains muhly, and prairie junegrass. Initially, blue grama, Sandberg bluegrass, inland saltgrasses, needleleaf sedge, and other upland sedges increase in abundance under these conditions. Further deterioration results in a dominance of blue grama, fringed sagebrush, upland sedges, and unpalatable forbs.

This site is fragile because of the shallow soil depth and a limited available water capacity. Management that maintains an adequate plant cover helps to protect the soil from erosion. Gullies can form along cattle trails

and in denuded areas. A planned grazing system is an excellent method of restoring productivity when the site is in poor or fair condition.

Shallow to Gravel range site. Grasses make up about 70 percent of the climax vegetation on this site. Needleandthread, western wheatgrass, green needlegrass, blue grama, plains muhly, red threeawn, and prairie junegrass are the principal species. Upland sedges make up about 15 percent of the vegetation. Forbs, such as rush skeletonplant, scarlet globemallow, dotted gayfeather, wooly goldenrod, and Hood phlox, make up about 10 percent. Fringed sagebrush and other shrubs make up the rest.

Continual heavy grazing results in a decrease in the abundance of western wheatgrass, green needlegrass, and needleandthread. The principal increasers are blue grama, red threeawn, upland sedges, Kentucky bluegrass, fringed sagebrush, and several forbs. Blue grama, red threeawn, upland sedges, fringed sagebrush, and low-quality forbs dominate the site when it is in poor condition.

Because of a low available water capacity, forage production is limited on this site. Water erosion is a hazard in areas that have a slope of more than 5 percent. Gullies can form along cattle trails and in denuded areas. Management that maintains an adequate cover of the key plants, which traps snow, and cross fencing, which helps to control the pattern of livestock traffic, help to maintain productivity.

Silty range site. Grasses make up about 75 percent of the vegetation. The major species are western wheatgrass, needleandthread, green needlegrass, blue grama, prairie junegrass, porcupinegrass, red threeawn, and Sandberg bluegrass. Upland sedges make up about 5 percent of the vegetation. Forbs, such as heath aster, prairie coneflower, green sagewort, scarlet globemallow, Hood phlox, and purple prairie-clover, make up about 10 percent. Shrubs, such as fringed sagebrush, western snowberry, silver sage, common winterfat, and prairie rose, make up the rest.

Overgrazing results in a decrease in the abundance of green needlegrass, porcupinegrass, and prairie junegrass. Western wheatgrass and needleandthread initially respond as increasers. If overgrazing continues, however, they decrease in abundance. Blue grama, Sandberg bluegrass, red threeawn, upland sedges, and a number of forbs are increasers. In areas with a long history of overgrazing, blue grama, red threeawn, upland sedges, fringed sagebrush, and green sagewort dominate the site.

Generally, no major hazards affect the management of this site. In the more sloping areas, however, gullies can form along livestock trails. Fencing and improved grazing management help to prevent gullying and improve gullied areas. Areas where the site is in poor or fair condition generally can be restored to good or excellent condition by good management. In some areas brush control is needed.

Subirrigated range site. The potential plant community on this site is dominated by tall, warm-season grasses, mainly big bluestem, switchgrass, indiangrass, and prairie cordgrass. These species and mid grasses, mainly little bluestem, make up about 85 percent of the vegetation. Sedges, Baltic rush, and common spikesedge make up about 5 percent. Maximilian sunflower, Rydberg's sunflower, tall goldenrod, tall white aster, and common wild mint and other forbs make up about 10 percent.

When this site is overgrazed, big bluestem, switchgrass, indiangrass, Maximilian sunflower, and Rydberg's sunflower are rapidly depleted. Little bluestem initially increases in abundance but then decreases. The major increasers are mat muhly, fowl bluegrass, Baltic rush, common spikerush, common wild mint, and rough cinquefoil. Continued heavy grazing results in a dominance of Kentucky bluegrass, Baltic rush, mat muhly, and undesirable sedges and grasses.

Because of the high percentage of warm-season grasses, this site can provide high-quality forage later in the growing season than many other sites. Where the plant community has deteriorated, deferment of grazing during the growing season or use of a planned grazing system can restore the site. In areas where the potential plant community has been destroyed by cultivation or by extremely severe overuse, range seeding can reestablish the major grass species.

Thin Claypan range site. The climax vegetation on this site is about 60 percent western wheatgrass and blue grama. Other grasses make up about 20 percent of the vegetation. Upland sedges and forbs each make up about 5 percent. Shrubs and half-shrubs make up the rest.

Western wheatgrass is the principal decreaser when this site is overgrazed. Other decreasers are prairie junegrass, wheatgrasses, and needleandthread. Blue grama, inland saltgrass, Sandberg bluegrass, and buffalograss are the principal increasers. Continued overgrazing results in the dominance of inland saltgrass, blue grama, other short grasses, upland sedges, fringed sagebrush, and broom snakeweed.

Because of the high content of salts near the surface, productivity is quite low on this site. The site produces good-quality forage only if properly managed. If the site is in poor or fair condition, recovery is slow because of the salts and a dense, alkali-affected subsoil. Stock water pits should not be constructed on this site because the water is likely to be salty. Careful management can maintain or restore the site to good or excellent condition. If the vegetation has been destroyed by cultivation or the site denuded, range seeding can restore the climax vegetation. Good seeding techniques are needed.

Very Shallow range site. About 80 percent of the climax vegetation on this site is needleandthread, western wheatgrass, little bluestem, blue grama, prairie junegrass, plains muhly, red threeawn, and other grasses. Upland sedges make up about 10 percent of the vegetation. Green sagewort, rush skeletonplant, dotted gayfeather, purple prairie-clover, western yarrow, and other forbs make up about 5 percent. Broom snakeweed, fringed sagebrush, and other shrubs make up the rest.

Western wheatgrass, needleandthread, prairie junegrass, and purple prairie-clover are the principal decreasers when this site is overgrazed. Blue grama, upland sedges, red threeawn, fringed sagebrush, and broom snakeweed are the principal increasers. Continued heavy use results in a dominance of upland sedges, red threeawn, fringed sagebrush, broom snakeweed, and a number of undesirable forbs.

Available water capacity is very low on this site. Also, water erosion is a hazard in the more sloping areas. Gullies can readily form along cattle trails and in denuded areas. The site is frequently overgrazed. Once it is in fair or poor condition, it recovers slowly because of the limited supply of available moisture. Productivity can be maintained by careful management of the mid grasses and by cross fencing, which helps to control livestock traffic patterns.

Wetland range site. The potential plant community on this site is about 50 percent grasses and 45 percent grasslike plants. The principal species are rivergrass and slough sedge. Other species are prairie cordgrass, northern reedgrass, American mannagrass, American sloughgrass, slim sedge, common spikesedge, and Baltic rush. Forbs, such as longroot smartweed, curled dock, Rydberg's sunflower, false aster, and tall white aster, make up about 5 percent of the vegetation.

If this site is continuously overgrazed, rivergrass and slough sedge are the principal decreasers. Slim sedge, Baltic rush, common spikesedge, and American sloughgrass are increasers. Heavy grazing results in a plant community dominated by Baltic rush, common spikesedge, false aster, and curled dock.

If possible, grazing should be limited to summer and fall on this site. Grazing during wet periods can result in compaction and root damage. A deteriorated plant community can be restored by deferment of grazing during the growing season or by use of a planned grazing system. In areas where the natural plant community has been destroyed, seeding reed canarygrass and creeping foxtail helps to restore forage production. If feasible, this site should be fenced from areas of other range sites.

Woodland, Windbreaks, and Environmental Plantings

By Bruce C. Wight, forester, Soil Conservation Service.

Hettinger County has about 200 acres of native woodland. This woodland is primarily along the Cannonball River and in "woody draws" on north- and northeast-facing slopes throughout the county. The woodland along the Cannonball River is primarily in areas of Korchea loam. The woody draws are mostly in areas of Savage clay loam. The only other native woodland consists of clumps of shrubs on rangeland.

The forest type along the Cannonball River is primarily American elm and green ash. Other less common tree and shrub species include boxelder, plains cottonwood, common chokecherry, silver buffaloberry, western snowberry, and Woods rose. In the woody draws, the primary species are green ash and scattered American elm. The understory is mostly common chokecherry, western snowberry, and saplings of green ash. The shrubs in scattered clumps on rangeland consist mostly of common chokecherry, silver buffaloberry, and western snowberry.

Early settlers used the trees for fuel, lumber, and fenceposts. Currently, there is a renewed interest in using trees for fuel. The principal uses of trees, however, are for protection and esthetic purposes. The trees protect the soil, homes, livestock, wildlife, and watersheds.

Windbreaks have been planted in Hettinger County since the days of settlement. Most of the early plantings were made to protect farmsteads and livestock. Since the 1930's, more than 3,500,000 trees have been planted on about 6,500 acres by farmers and landowners with assistance from the Soil Conservation

Service and the Slope-Hettinger Soil Conservation District. Trees and shrubs are still needed around numerous farmsteads, but the major need is for windbreaks that help to protect soils that are highly susceptible to soil blowing.

The following factors should be considered before a planting is made: (1) the purpose of the planting; (2) the suitability of the soils; (3) the adaptability of the various species of trees and shrubs; (4) the location and design of the windbreak; and (5) the availability of hardy, adapted trees and shrubs. If these factors are not considered, a poor or unsuccessful windbreak may result.

The establishment of a windbreak or an environmental planting and the growth of the trees and shrubs also depend on suitable site preparation and adequate maintenance after the trees and shrubs are planted. Grasses and weeds should be eliminated before the planting is made, and regrowth of the competing ground cover should be controlled for the life of the windbreak. Some replanting of the trees and shrubs may be necessary during the first 2 years after planting.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

By David D. Dewald, biologist, Soil Conservation Service.

Hettinger County has a limited public recreational resource. Indian Creek Dam provides picnicking and camping facilities and fishing opportunities. Picnicking facilities are also available in the towns of Mott, New England, and Regent.

Public land available for recreational activities is limited to land administered by the State of North Dakota. About 10,000 acres is administered by the Department of University and School Lands and is available for public hunting. The 1,200-acre Indian Creek Wildlife Management Area, which is administered by the North Dakota Game and Fish Department, is also available for hunting and recreational activities.

In addition to the public fishing areas listed in the section "Wildlife Habitat," numerous private lake owners permit fishing. The potential to develop additional private and public fishing areas in the county is fair.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table

11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

By David D. Dewald, biologist, Soil Conservation Service.

Fish and wildlife resources provide an important contribution to the social and economic well-being of residents and visitors in Hettinger County.

Wildlife populations have declined since the county was settled. Intensive cropping and year-long grazing of rangeland have reduced the quantity and quality of wildlife habitat.

In 1984 about 27 percent of the people in the survey area purchased fishing licenses, 14 percent purchased resident general game licenses, and 7 percent purchased furbearer licenses. Hettinger County had an average deer harvest of 378 deer per 1,000 square miles in 1984. Of the 36 deer hunting units in North Dakota, only four units have an annual deer kill per 1,000 square miles that is less than those in which Hettinger County is located.

Game and nongame wildlife species in the county are varied. Bird species that are hunted include ring-necked pheasant, gray partridge, sharp-tailed grouse, ducks, geese, and mourning dove. Mammals that are trapped or hunted are white-tailed deer, mule deer, pronghorn antelope, red fox, coyote, cottontail rabbit, white-tailed jackrabbit, raccoon, striped skunk, badger, beaver, mink, and muskrat.

About 1,200 acres of land in the county is managed by the North Dakota Game and Fish Department for wildlife. Private landowners manage about 2,500 acres primarily for wildlife. Food and cover for wildlife could increase as minimum tillage and no-till farming increase on cropland in the county.

Fishing in the county is mostly limited to constructed impoundments. These impoundments include Indian Creek Dam, Kilzer Dam, Castle Rock Dam, Mott Watershed Dam, Cedar Dam, and Blickensderfer Dam. The Cannonball River also provides a fishing resource. Species of fish in the county include rainbow trout, walleye pike, smallmouth bass, bluegill, yellow perch, and northern pike.

About 23,000 acres in Hettinger County, or a little more than 3 percent of the total acreage, meets the requirements for hydric soils. The map units in the county that generally display hydric conditions are listed at the end of this paragraph. They may have been artificially drained or otherwise altered so that they no longer support a predominance of hydrophytic vegetation. The soil maps in this survey do not identify the drained areas. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4, and the location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

2	Heil silty clay loam
3	Dimmick silty clay
26	Regan loam, 0 to 3 percent slopes
28	Harriet loam

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or

by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are tall wheatgrass, intermediate wheatgrass, sweetclover, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, green needlegrass, western wheatgrass, and blue grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are juneberry, dogwood, western snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include gray partridge, pheasant, meadowlark, lark bunting, cottontail, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sharp-tailed grouse, meadowlark, and horned lark.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water

management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping

and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by

toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates

are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 16, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years;

and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the North Dakota State Highway Department.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll (*Bor*, meaning cool, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haploborolls (*Hapl*, meaning minimal horizonation, plus *boroll*, the suborder of the Mollisols that has a frigid temperature regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haploborolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed Typic Haploborolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (19)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (20)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Amor Series

The Amor series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 25 percent.

Typical pedon of an Amor loam in an area of Amor-Cabba loams, 6 to 9 percent slopes, 1,300 feet south and 1,000 feet west of the northeast corner of sec. 33, T. 136 N., R. 91 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; neutral; abrupt smooth boundary.

Bw—5 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; few distinct clay films on faces of peds; mildly alkaline; gradual wavy boundary.

Bk—14 to 23 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—23 to 30 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr—30 to 60 inches; light brownish gray (2.5Y 6/2), soft mudstone, grayish brown (2.5Y 5/2) moist; slightly effervescent; mildly alkaline.

The thickness of the mollic epipedon is 7 to 15 inches. The thickness of the solum and the depth to soft bedrock range from 20 to 40 inches. The depth to carbonates is 13 to 21 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bw horizon has hue of 10YR or 2.5Y and chroma of 2 to 4. It is loam or clay loam. The Bk horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 to 6 moist), and chroma of 2 to 4. The Cr horizon is soft mudstone, sandstone, or siltstone.

Arnegard Series

The Arnegard series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in alluvium. Slope is 1 to 3 percent.

Typical pedon of Arnegard loam, 1 to 3 percent slopes, 1,700 feet west and 1,575 feet north of the southeast corner of sec. 35, T. 132 N., R. 93 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and many very fine roots; neutral; clear smooth boundary.

A—6 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; neutral; gradual wavy boundary.

Bw1—13 to 27 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; many very fine roots; neutral; clear wavy boundary.

Bw2—27 to 36 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; mildly alkaline; clear wavy boundary.

Bk—36 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; few fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 16 to 40 inches. The thickness of the solum is 25 to 60 inches or more. The depth to carbonates is 19 to 42 inches.

The A horizon has value of 3 or 4 (2 or 3 moist). The Bw horizon has value of 3 to 5 (2 to 4 moist) and chroma of 2 or 3. It is loam or clay loam. Some pedons have an Ab horizon or a C horizon.

Beisigl Series

The Beisigl series consists of moderately deep,

somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 50 percent.

Typical pedon of a Beisigl loamy fine sand in an area of Beisigl-Lihen loamy fine sands, 1 to 6 percent slopes, 500 feet south and 50 feet west of the northeast corner of sec. 28, T. 134 N., R. 91 W.

A—0 to 2 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

Bk1—2 to 8 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many very fine roots; disseminated lime throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—8 to 24 inches; light yellowish brown (2.5Y 6/4) loamy fine sand, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; common very fine roots; about 10 percent sandstone channers; disseminated lime throughout; violently effervescent; moderately alkaline; gradual wavy boundary.

Cr—24 to 60 inches; pale yellow (2.5Y 7/4), brownish yellow (10YR 6/6), and light yellowish brown (2.5Y 6/4), soft sandstone, light olive brown (2.5Y 5/4) moist; few very fine roots; strongly effervescent; moderately alkaline.

The depth to soft sandstone is 20 to 40 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. In some pedons the A horizon is noncalcareous. The Bk horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is loamy fine sand or fine sand.

Belfield Series

The Belfield series consists of deep, well drained and moderately well drained, slowly permeable, alkali soils on terraces and uplands. These soils formed in alluvium. Slope is 0 to 6 percent.

Typical pedon of a Belfield clay loam in an area of Belfield-Grail clay loams, 0 to 3 percent slopes, 50 feet north and 1,900 feet west of the southeast corner of sec. 20, T. 133 N., R. 97 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; many very fine roots; neutral; abrupt smooth boundary.

A—6 to 8 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; neutral; clear smooth boundary.

B/E—8 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist (B); light brownish gray (10YR 6/2) coatings on faces of peds (E); moderate coarse and medium subangular blocky structure parting to moderate thin platy; hard, friable, slightly sticky and slightly plastic; many very fine roots; neutral; clear smooth boundary.

Bt—13 to 28 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, very sticky and very plastic; many very fine roots; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bk—28 to 54 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; few very fine roots; common fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C—54 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and slightly plastic; few thin strata of lignite; common fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 11 to 30 inches. The thickness of the solum is 28 to 60 inches. The depth to carbonates is 20 to 48 inches. Some pedons are saline.

The A horizon has value of 2 or 3 moist. The B/E horizon has value of 4 to 6 (2 to 4 moist). It is silty clay loam, silt loam, or loam. Some pedons do not have a B/E horizon but have an E horizon. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 5 moist), and chroma of 2 to 4. It is silty clay loam or silty clay. The C horizon is clay, silty clay, silty clay loam, or clay loam. The C horizon in some pedons is stratified with coarser

textured material. Some pedons have a Cr horizon at a depth of 42 to 60 inches.

Bowdle Series

The Bowdle series consists of deep, well drained soils on terraces. These soils formed in alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slope is 0 to 6 percent.

Typical pedon of Bowdle loam, 3 to 6 percent slopes, 2,300 feet east and 1,100 feet north of the southwest corner of sec. 8, T. 136 N., R. 94 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; neutral; clear smooth boundary.

Bw1—6 to 12 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; many very fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bw2—12 to 28 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; many very fine roots; about 2 percent gravel; neutral; clear wavy boundary.

2C—28 to 60 inches; light yellowish brown (2.5Y 6/4) very gravelly sand, olive brown (2.5Y 4/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; about 40 percent gravel; accumulations of lime on the underside of pebbles; strongly effervescent; mildly alkaline.

The thickness of the mollic epipedon is 16 to 32 inches. The thickness of the solum and the depth to sand and gravel range from 20 to 37 inches. The depth to carbonates or pebbles is 18 to 37 inches.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The Bw horizon has value of 3 or 4 moist and chroma of 2 or 3. Some pedons have a Bk horizon. The 2C horizon is very gravelly sand to gravelly loamy sand.

Brandenburg Series

The Brandenburg series consists of deep, excessively drained soils on uplands. These soils formed in material weathered from shattered porcellanite. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Slope is 6 to 70 percent.

Typical pedon of a Brandenburg channery loam in an area of Brandenburg-Cabba-Savage complex, 6 to 70 percent slopes, 1,800 feet south and 200 feet west of the northeast corner of sec. 33, T. 133 N., R. 92 W.

A—0 to 4 inches; brown (7.5YR 5/4) channery loam, dark brown (7.5YR 4/4) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; few fine and many very fine roots; about 15 percent porcellanite channers; neutral; clear wavy boundary.

C1—4 to 16 inches; light brown (7.5YR 6/4) very channery loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; about 45 percent porcellanite channers; mildly alkaline; clear wavy boundary.

C2—16 to 60 inches; pinkish white (5YR 8/2) and light red (2.5YR 6/6), shattered porcellanite, pinkish gray (5YR 7/2) and reddish brown (2.5YR 4/4) moist; accumulations of lime on the underside of porcellanite fragments; slightly effervescent; mildly alkaline.

The depth to shattered porcellanite is 10 to 20 inches. The A horizon has hue of 5YR or 7.5YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 to 4.

Cabba Series

The Cabba series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 6 to 70 percent.

Typical pedon of a Cabba loam in an area of Amor-Cabba loams, 9 to 15 percent slopes, 2,460 feet south and 390 feet east of the northwest corner of sec. 27, T. 133 N., R. 97 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

AC—4 to 9 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly

sticky and slightly plastic; common very fine roots; disseminated lime throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—9 to 13 inches; pale yellow (2.5Y 7/4) loam, light yellowish brown (2.5Y 6/4) moist; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; continuous, brownish yellow (10YR 6/8 moist), iron-enriched layer at a depth of 12 to 13 inches; disseminated lime throughout; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Cr—13 to 60 inches; light gray (2.5Y 7/2), soft siltstone, grayish brown (2.5Y 5/2) moist; few very fine roots; common brownish yellow (10YR 6/8 moist) iron stains; strongly effervescent; moderately alkaline.

The depth to soft bedrock is 10 to 20 inches. The depth to carbonates is 0 to 8 inches.

The A horizon has hue of 10YR or 2.5Y and value of 4 to 6 (3 or 4 moist). It is loam or silt loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is loam or silt loam. The Cr horizon is soft mudstone or siltstone.

Chama Series

The Chama series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 35 percent.

Typical pedon of Chama silt loam, 3 to 6 percent slopes, 100 feet north and 1,325 feet west of the southeast corner of sec. 3, T. 134 N., R. 97 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; slightly effervescent; mildly alkaline; abrupt smooth boundary.

Bk1—6 to 13 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common fine and medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—13 to 31 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; common very fine roots; about 5 percent siltstone channers; common medium irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Cr—31 to 60 inches; pale olive (5Y 6/3) and gray (5Y 6/1), soft siltstone, olive (5Y 5/3) and gray (5Y 5/1) moist; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 10 inches. The depth to soft bedrock is 20 to 40 inches. The depth to carbonates is 0 to 12 inches.

The A horizon has value of 4 or 5. The Bk horizon has hue of 10YR or 2.5Y and value of 4 to 7 (3 to 6 moist). In some pedons the Cr horizon has few to many gypsum crystals.

Daglum Series

The Daglum series consists of deep, well drained and moderately well drained, very slowly permeable, alkali soils on terraces and uplands. These soils formed in alluvium and material weathered from soft bedrock. Slope is 1 to 25 percent.

Typical pedon of a Daglum clay loam in an area of Belfield-Daglum clay loams, 1 to 3 percent slopes, 35 feet west and 30 feet north of the southeast corner of sec. 14, T. 134 N., R. 95 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots; slightly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; brown (10YR 4/3) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong fine and medium angular blocky; very hard, firm, very sticky and very plastic; many very fine roots along faces of peds; top of columns coated with light brownish gray (10YR 6/2) silt; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt2—13 to 19 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate fine and medium angular blocky; very hard, firm, very sticky and very plastic; many very fine roots; common distinct clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bk1—19 to 26 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium

subangular blocky; very hard, firm, very sticky and very plastic; common very fine roots; few fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; clear wavy boundary.

Bk2—26 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cy1—32 to 40 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; massive; very hard, firm, sticky and plastic; common fine gypsum crystals; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Cy2—40 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common fine and medium prominent yellowish brown (10YR 5/8 moist) mottles; massive; very hard, firm, sticky and plastic; common fine gypsum crystals; slightly effervescent; moderately alkaline.

The thickness of the solum is 24 to 60 inches. The depth to carbonates is 12 to 32 inches. Some pedons are saline.

The A horizon has value of 4 or 5 (2 or 3 moist). It is loam or clay loam. Some pedons have an E horizon 1 to 3 inches thick. The Bt horizon has hue of 10YR or 2.5Y and value of 4 to 6 (3 to 5 moist). It is clay, silty clay, silty clay loam, or clay loam. The Cy horizon is clay loam, silty clay loam, silty clay, or clay. It is stratified with coarser material in some pedons. The Cy horizon commonly has few and common, prominent and distinct mottles; however, it is not mottled in some pedons. Some pedons have a Cr horizon at a depth of 40 to 60 inches. Some pedons have an Ab horizon.

The Daglum soils in the Regent-Daglum complex, 1 to 3 percent slopes, Regent-Daglum complex, 3 to 6 percent slopes, and Sinnigam-Daglum complex, 1 to 25 percent slopes, are taxadjuncts to the Daglum series because they are moderately deep to soft shale. This difference, however, does not alter the usefulness or behavior of the soil.

Dimmick Series

The Dimmick series consists of deep, very poorly drained, very slowly permeable soils on uplands. These soils formed in alluvium. Slope is 0 to 1 percent.

Typical pedon of Dimmick silty clay, 1,650 feet south and 335 feet west of the northeast corner of sec. 35, T. 136 N., R. 91 W.

Oi—2 inches to 0; partially decomposed mat of roots, stems, and leaves; many very fine and fine roots, common medium roots, and few coarse roots; abrupt smooth boundary.

A—0 to 4 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; many fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; hard, firm, very sticky and very plastic; many fine roots; slightly acid; clear smooth boundary.

Ag—4 to 14 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; many fine prominent dark yellowish brown (10YR 4/6) mottles; strong medium and fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots; neutral; gradual wavy boundary.

Bg—14 to 31 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; strong fine and medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; mildly alkaline; gradual wavy boundary.

Cg1—31 to 39 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; many large distinct olive (5Y 4/4) mottles; weak fine prismatic structure; extremely hard, very firm, very sticky and very plastic; mildly alkaline; clear wavy boundary.

Cg2—39 to 60 inches; light gray (5Y 7/2) clay, light olive gray (5Y 6/2) moist; many medium distinct olive yellow (5Y 6/6) mottles; massive; extremely hard, very firm, very sticky and very plastic; common medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 14 to 24 inches. The thickness of the solum is 31 to 60 inches. The depth to carbonates is 25 to 40 inches.

The A horizon has hue of 10YR, 2.5Y, or 5Y. Some pedons do not have an O horizon. The Cg horizon is mainly silty clay or clay. It is stratified in the lower part and has coarser textured material in some pedons.

Ekalaka Series

The Ekalaka series consists of deep, well drained, slowly permeable, alkali soils on terraces and uplands. These soils formed in alluvium and material weathered from soft bedrock. Slope is 1 to 6 percent.

Typical pedon of Ekalaka fine sandy loam, 1 to 6 percent slopes, 1,100 feet north and 680 feet west of the southeast corner of sec. 13, T. 132 N., R. 91 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; slightly acid; abrupt smooth boundary.

Bt—7 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; strong coarse prismatic structure parting to weak medium subangular blocky; extremely hard, very firm, sticky and plastic; common very fine and fine roots; many distinct clay films on faces of peds; moderately alkaline; gradual wavy boundary.

Bky1—17 to 33 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common medium irregularly shaped masses of gypsum and lime; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bky2—33 to 43 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common medium irregularly shaped masses of gypsum; few fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; gradual wavy boundary.

C—43 to 60 inches; pale yellow (2.5Y 7/4) fine sandy loam, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common medium irregularly shaped masses of gypsum; many medium irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 16 inches. The depth to carbonates is 17 to 43 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. Undisturbed pedons have an E horizon. The Bt horizon has value of 4 or 5 (3 or 4 moist) and chroma of 3 or 4. It is fine sandy loam or sandy loam. The Bky horizon has value of 4 to 7 (3 to 6 moist) and chroma of 3 or 4. It is fine sandy loam, sandy loam, or loam. The C horizon has value of 6 or 7 (4 to 6 moist). It is fine sandy loam, loamy fine sand, fine sand, or sandy loam. Some pedons have a Cr horizon below a depth of 40 inches.

Felor Series

The Felor series consists of deep, well drained soils on uplands and terraces. These soils formed in alluvium and in material weathered from bedrock. Permeability is moderate in the upper part of the profile and slow in the lower part. Slope is 1 to 6 percent.

Typical pedon of Felor loam, 1 to 6 percent slopes, 1,280 feet west and 2,750 feet north of the southeast corner of sec. 4, T. 136 N., R. 97 W.

A—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

Bw—4 to 8 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt1—8 to 17 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, slightly sticky and plastic; many very fine roots; many distinct clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

Bt2—17 to 30 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, sticky and plastic; many very fine roots; many distinct clay films on faces of peds; about 3 percent gravel; mildly alkaline; gradual wavy boundary.

2Bk—30 to 41 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and plastic; common very fine roots; about 5 percent gravel; common large soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

2C—41 to 60 inches; pink (5YR 7/4) silty clay, light reddish brown (5YR 6/4) moist; massive; very hard, very firm, very sticky and plastic; few very fine roots; common large soft masses of lime; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 15 inches. The thickness of the solum is 25 to 44 inches. The depth to clayey material is 20 to 35 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 7 (3 to 6 moist), and chroma of 2 to 4. It is loam, clay loam, or sandy clay loam. The 2Bk horizon has hue of 7.5YR to 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is silty clay, clay, or silty clay loam. Some pedons do not have a 2Bk horizon. The 2C horizon has hue of 5YR to 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 6. It is silty clay, clay, or silty clay loam.

Flasher Series

The Flasher series consists of shallow, somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 3 to 70 percent.

Typical pedon of a Flasher loamy fine sand in an area of Flasher-Beisigl-Parshall complex, 6 to 70 percent slopes, extremely stony; 5 feet east and 5 feet south of the northwest corner of sec. 34, T. 134 N., R. 91 W.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; disseminated lime throughout; strongly effervescent; mildly alkaline; clear wavy boundary.

AC—4 to 15 inches; light yellowish brown (2.5Y 6/4) loamy fine sand, light olive brown (2.5Y 5/4) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, nonsticky and nonplastic; common very fine roots; disseminated lime throughout; violently effervescent; moderately alkaline; abrupt wavy boundary.

Cr—15 to 60 inches; light gray (5Y 7/2) and pale yellow (5Y 7/3), soft sandstone, light olive gray (5Y 6/2) and pale olive (5Y 6/3) moist; few very fine roots along fractures; slightly effervescent; moderately alkaline.

The depth to soft bedrock is 7 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It is fine sandy loam or loamy fine sand. The AC horizon has hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4. The Cr horizon crushes to loamy fine sand, loamy sand, or sand; however, hard lenses occur in some pedons.

Grail Series

The Grail series consists of deep, well drained, slowly permeable soils on terraces and uplands. These soils formed in alluvium. Slope is 0 to 3 percent.

Typical pedon of Grail clay loam, 1 to 3 percent slopes, 50 feet north and 800 feet west of the southeast corner of sec. 13, T. 132 N., R. 94 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; common very fine and few fine roots; slightly acid; abrupt smooth boundary.

A—7 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, firm, sticky and plastic; common very fine and few fine roots; slightly acid; clear wavy boundary.

Bt—12 to 24 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, very sticky and very plastic; common very fine roots; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

Btk—24 to 31 inches; light yellowish brown (2.5Y 6/4) silty clay, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, very sticky and very plastic; common very fine roots; common distinct clay films on faces of peds; few medium rounded soft masses of lime; slightly effervescent; mildly alkaline; gradual wavy boundary.

Bk—31 to 41 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; common very fine roots; few medium rounded soft masses of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

BC—41 to 50 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few very fine roots; slightly effervescent; moderately

alkaline; gradual wavy boundary.

C—50 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; few very fine roots; slightly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 16 to 33 inches. The thickness of the solum is 47 to 60 inches. The depth to carbonates is 24 to 47 inches. Some pedons are saline.

The A horizon has value of 4 or 5, and it has chroma of 1 or 2 dry and 2 moist. The Bt horizon has hue of 10YR or 2.5Y and value of 4 or 5 (2 or 3 moist). It is clay, silty clay, silty clay loam, or clay loam. The Bk horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is silty clay loam or clay loam. The C horizon is clay loam, silty clay loam, silty clay, or clay.

Harriet Series

The Harriet series consists of deep, poorly drained, very slowly permeable, alkali, saline soils on flood plains and uplands. These soils formed in alluvium. Slope is 0 to 1 percent.

Typical pedon of Harriet loam, 1,200 feet west and 1,450 feet north of the southeast corner of sec. 20, T. 135 N., R. 94 W.

E—0 to 4 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak medium platy structure; slightly hard, friable, sticky and plastic; many very fine and common fine roots; moderately alkaline; clear wavy boundary.

Btkz1—4 to 9 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse and very coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; common very fine and fine roots; common faint clay films on faces of peds; about 5 percent gravel; common fine irregularly shaped threads and soft masses of salts; few fine irregularly shaped soft masses of lime; slightly effervescent; strongly alkaline; clear wavy boundary.

Btkz2—9 to 26 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots; few faint clay films on faces of peds; about 5 percent gravel; common fine and medium irregularly shaped threads and soft masses of salts; few fine irregularly shaped soft masses of lime; slightly effervescent; strongly alkaline; gradual wavy boundary.

Bky—26 to 40 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium prominent yellowish brown (10YR 5/4 moist) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few very fine roots; about 5 percent gravel; common medium irregularly shaped soft masses of gypsum; few fine irregularly shaped soft masses of lime; slightly effervescent; strongly alkaline; clear wavy boundary.

C—40 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; many medium prominent dark yellowish brown (10YR 4/4 moist) mottles; massive; very hard, firm, sticky and plastic; about 5 percent gravel; many medium irregularly shaped soft masses of gypsum; few fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline.

The thickness of the solum is 30 to 40 inches. The depth to carbonates and salts is 0 to 8 inches.

The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. In some pedons the E horizon has been mixed, by cultivation, with the upper part of the B horizon. The Btkz horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. It is silty clay, clay loam, or clay. The C horizon has hue of 2.5Y or 5Y and value of 5 to 7 (4 to 5 moist). It is clay, silty clay, clay loam, silty clay loam, or loam.

Heil Series

The Heil series consists of deep, poorly drained, very slowly permeable, alkali soils on uplands. These soils formed in alluvium. Slope is 0 to 1 percent.

Typical pedon of Heil silty clay loam (fig. 10), 500 feet south and 5 feet east of the northwest corner of sec. 27, T. 136 N., R. 94 W.

E—0 to 3 inches; light gray (2.5Y 7/2) and white (10YR 8/1) silty clay loam, grayish brown (2.5Y 5/2) moist; few medium prominent dark brown (7.5YR 3/4) and dark reddish brown (5YR 3/2) mottles; weak medium platy structure; slightly hard, friable, sticky and plastic; many fine roots and common very fine and medium roots; neutral; abrupt smooth boundary.

Btg1—3 to 12 inches; gray (5Y 5/1) silty clay, very dark

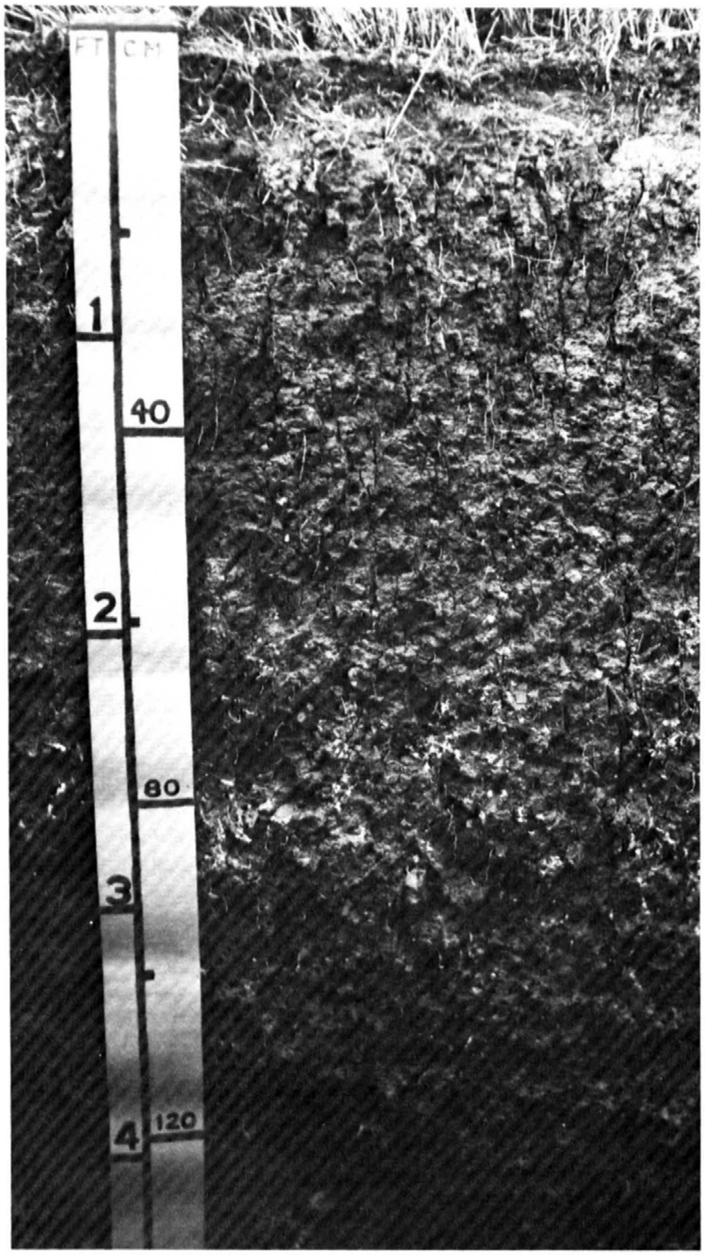

Figure 10.—Typical profile of Heil silty clay loam, showing the thin surface layer and the columnar and prismatic structure of the subsoil.

gray (5Y 3/1) moist; few medium prominent dark olive gray (5Y 3/2) mottles; moderate coarse columnar structure parting to moderate medium subangular blocky; very hard, very firm, sticky and very plastic; common very fine and few fine roots; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Btg2—12 to 17 inches; gray (5Y 5/1) silty clay, dark olive gray (5Y 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; common very fine roots; many distinct clay films on faces of peds; slightly effervescent; mildly alkaline; clear wavy boundary.

Bkyg1—17 to 25 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; common very fine roots; few fine irregularly shaped soft masses of gypsum; common fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; clear wavy boundary.

Bkyg2—25 to 32 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure; very hard, very firm, sticky and plastic; common very fine roots; common fine irregularly shaped soft masses of gypsum; few fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; clear wavy boundary.

Bkyg3—32 to 42 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure; very hard, very firm, sticky and plastic; common very fine roots; few fine irregularly shaped soft masses of gypsum; common fine irregularly shaped seams of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

Bg—42 to 52 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure; very hard, very firm, sticky and plastic; common very fine roots; few fine irregularly shaped seams of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

Cg—52 to 60 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; massive; very hard, very firm, sticky and plastic; common very fine roots; disseminated lime throughout; strongly effervescent; strongly alkaline.

The thickness of the mollic epipedon is 8 to 52 inches. The depth to gypsum is 13 to 60 inches. The thickness of the solum is 32 to 60 inches. The depth to carbonates is 10 to 38 inches.

The E horizon has hue of 10YR or 2.5Y, value of 4 to 8 (2 to 5 moist), and chroma of 1 or 2. The B horizon has hue of 10YR to 5Y and value of 4 to 6 (3 or 4

moist). It is silty clay or clay. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is silty clay, silty clay loam, or clay.

Korchea Series

The Korchea series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 3 percent.

Typical pedon of Korchea loam, 0 to 3 percent slopes, 20 feet north and 1,300 feet east of the southwest corner of sec. 4, T. 133 N., R. 92 W.

A1—0 to 5 inches; stratified grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; mildly alkaline; abrupt smooth boundary.

A2—5 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; mildly alkaline; clear smooth boundary.

C1—8 to 26 inches; light brownish gray (10YR 6/2), stratified loam and silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—26 to 36 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C3—36 to 45 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; slightly effervescent; moderately alkaline; clear wavy boundary.

Ab—45 to 51 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; slightly effervescent; moderately alkaline; clear wavy boundary.

C'4—51 to 60 inches; grayish brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; slightly effervescent; moderately alkaline.

The depth to carbonates is 0 to 10 inches. Some pedons do not have an Ab horizon. The C horizon has chroma of 2 or 3. It is loam, sandy loam, silt loam, or clay loam.

Lawther Series

The Lawther series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in alluvium. Slope is 1 to 3 percent.

Typical pedon of Lawther silty clay, 1 to 3 percent slopes, 2,200 feet north and 1,800 feet east of the southwest corner of sec. 24, T. 133 N., R. 93 W.

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and very plastic; common fine and very fine roots; slightly effervescent; mildly alkaline; clear smooth boundary.

Bw—8 to 21 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium angular and subangular blocky; very hard, extremely firm, very sticky and very plastic; common fine and very fine roots; tongues of A horizon about 0.5 inch wide; slightly effervescent; mildly alkaline; gradual wavy boundary.

Bk—21 to 29 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few pebbles; few fine rounded soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bky—29 to 42 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; few fine roots; few pebbles; common fine irregularly shaped soft masses of gypsum; few

fine rounded soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; massive; very hard, firm, sticky and plastic; common fine irregularly shaped soft masses of gypsum; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 14 inches thick. The solum is 39 to 60 inches thick. The depth to carbonates is 0 to 11 inches. The depth to salts is 22 to 60 inches.

The A horizon has hue of 10YR or 2.5Y and value of 4 or 5. The Bw horizon has value of 4 to 6 (3 or 4 moist). It is silty clay or clay. The Bk horizon has value of 4 to 6 (3 to 5 moist). The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is silty clay or clay.

Lefor Series

The Lefor series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 0 to 6 percent.

The Lefor soils in this county do not have a mollic epipedon, which is definitive for the Lefor series. This difference, however, does not alter the usefulness or behavior of the soils.

Typical pedon of Lefor fine sandy loam, 3 to 6 percent slopes, 2,400 feet west and 2,600 feet north of the southeast corner of sec. 4, T. 136 N., R. 96 W.

A—0 to 7 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; slightly acid; clear smooth boundary.

B/E—7 to 15 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; strong coarse prismatic structure (B) parting to moderate medium platy (E); slightly hard, very friable, sticky and plastic; common very fine roots; few faint clay films in pores and on faces of peds; neutral; clear smooth boundary.

Bt—15 to 21 inches; yellow (10YR 7/6) loam, brownish yellow (10YR 6/6) moist; strong coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; common very fine roots; common faint clay films in pores and on faces of peds; mildly alkaline; clear smooth boundary.

Bk—21 to 38 inches; yellow (10YR 8/8) loam, brownish yellow (10YR 6/8) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable, sticky and plastic; common very fine roots; common fine and medium irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; clear smooth boundary.

Cr—38 to 60 inches; white (2.5Y 8/2) and pale yellow (2.5Y 7/4), soft sandstone, light gray (2.5Y 7/2) and light yellowish brown (2.5Y 6/4) moist; slightly hard, very friable, sticky and plastic; few very fine roots; few irregularly shaped soft masses of gypsum; slightly effervescent; moderately alkaline.

The thickness of the solum is 25 to 40 inches. The depth to soft bedrock is 20 to 40 inches. The depth to carbonates is 16 to 27 inches.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. The Bt horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. It is sandy clay loam or loam. The Bk horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 4 to 8. It is fine sandy loam or loam. The Cr horizon has a high content of kaolinitic clay.

Lefor fine sandy loam, 0 to 3 percent slopes, is a taxadjunct to the series because it is deep to soft sandstone. This difference, however, does not alter the usefulness or behavior of the soil.

Lehr Series

The Lehr series consists of deep, somewhat excessively drained soils on terraces. These soils formed in alluvium. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slope is 1 to 15 percent.

Typical pedon of a Lehr loam in an area of Lehr-Bowdle loams, 1 to 6 percent slopes, 800 feet west and 2,200 feet south of the northeast corner of sec. 12, T. 134 N., R. 95 W.

Ap—0 to 5 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; neutral; clear smooth boundary.

Bw1—5 to 11 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and

common fine roots; neutral; clear wavy boundary.

Bw2—11 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and slightly plastic; many very fine roots; few distinct very dark grayish brown (10YR 3/2 moist) coatings on faces of peds; about 5 percent gravel; mildly alkaline; gradual wavy boundary.

2C1—15 to 31 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; about 35 percent gravel; mildly alkaline; clear wavy boundary.

2C2—31 to 60 inches; light olive brown (2.5Y 5/4) and light yellowish brown (2.5Y 6/4) very gravelly loamy sand, olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) moist; single grain; loose, nonsticky and nonplastic; about 50 percent gravel; lime accumulations on the underside of pebbles; slightly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 15 inches. The depth to sand and gravel is 14 to 20 inches.

The A horizon has value of 4 or 5 and chroma of 2 or 3. The Bw horizon has value of 4 to 6 (3 or 4 moist). The content of gravel in the 2C horizon is 25 to 55 percent.

Lihen Series

The Lihen series consists of deep, well drained, rapidly permeable soils on terraces and uplands. These soils formed in alluvium and eolian sediment. Slope is 1 to 6 percent.

Typical pedon of Lihen loamy fine sand, 1 to 6 percent slopes, 440 feet east and 1,000 feet south of the northwest corner of sec. 36, T. 133 N., R. 94 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium and coarse granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; neutral; abrupt smooth boundary.

A—4 to 15 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; soft, very friable, nonsticky and nonplastic; common very fine roots; mildly alkaline; abrupt wavy boundary.

AC—15 to 24 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; soft, very friable, nonsticky and nonplastic; common very fine roots; disseminated lime throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—24 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grain; soft, very friable, nonsticky and nonplastic; few very fine roots; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 10 to 20 inches. The depth to carbonates is 0 to 31 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. Some pedons do not have an AC horizon but have a Bw or Bk horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It is fine sand or loamy fine sand.

Moreau Series

The Moreau series consists of moderately deep, well drained and moderately well drained, slowly permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 6 percent.

The Moreau soils in this county do not have a mollic epipedon, which is definitive for the Moreau series. This difference, however, does not alter the usefulness or behavior of the soils.

Typical pedon of Moreau silty clay, 1 to 3 percent slopes (fig. 11), 1,625 feet west and 50 feet north of the southeast corner of sec. 8, T. 134 N., R. 96 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; mildly alkaline; abrupt smooth boundary.

Bw—4 to 10 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, friable, very sticky and very plastic; common very fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

Bk1—10 to 15 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, friable, very sticky and very plastic; common very fine roots; common medium irregularly shaped soft

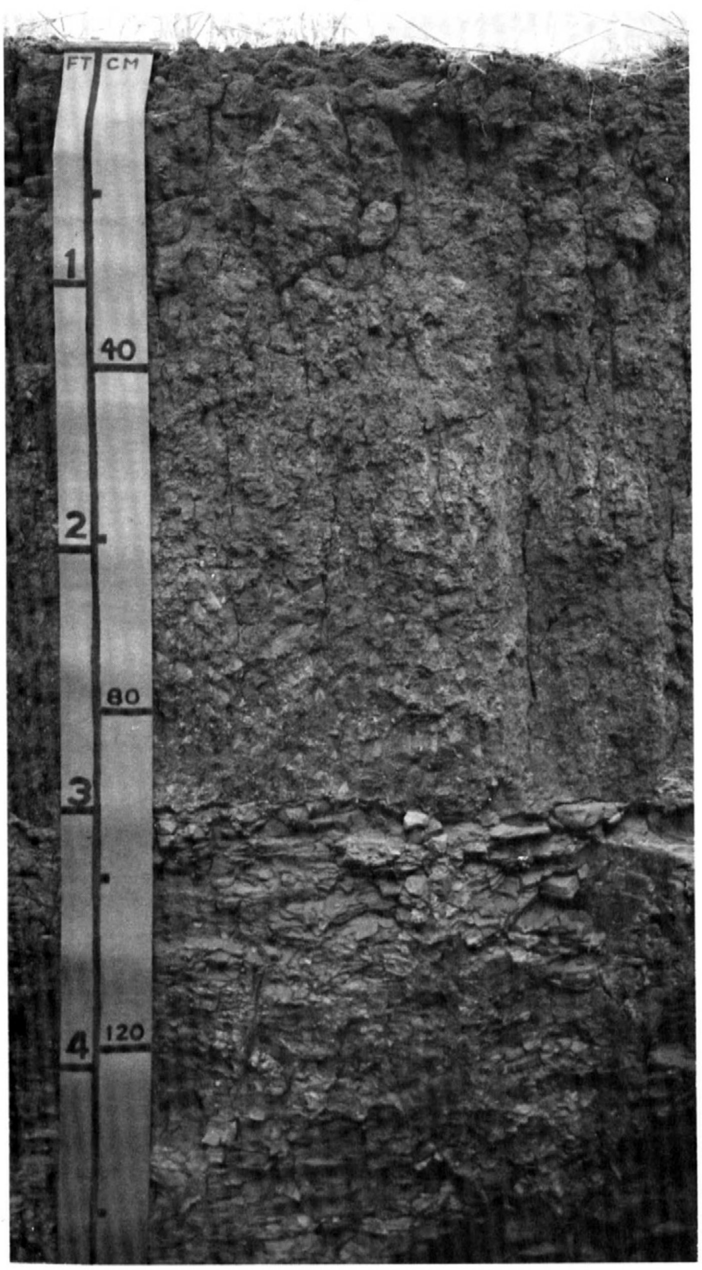

Figure 11.—Typical profile of Moreau silty clay, 1 to 3 percent slopes. Shale is at a depth of about 35 inches.

masses of lime; strongly effervescent; mildly alkaline; clear wavy boundary.

Bk2—15 to 24 inches; pale olive (5Y 6/3) silty clay, olive (5Y 4/3) moist; moderate medium prismatic structure parting to strong fine angular blocky; very hard, friable, very sticky and very plastic; common very fine roots; few medium irregularly shaped soft masses of lime; strongly effervescent; mildly alkaline; clear wavy boundary.

Bky—24 to 35 inches; light olive gray (5Y 6/2) and pale olive (5Y 6/3) channery silty clay, olive gray (5Y 4/2) and olive (5Y 4/3) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, friable, very sticky and very plastic; few very fine roots; about 20 percent shale channers; many fine masses of gypsum; few medium irregularly shaped soft masses of lime; strongly effervescent; mildly alkaline; abrupt wavy boundary.

Cr—35 to 60 inches; light olive gray (5Y 6/2) and gray (5Y 6/1) soft shale, olive gray (5Y 4/2) and dark gray (5Y 4/1) moist; yellowish brown (10YR 5/6), oxidized lenses at a depth of 36 inches; few distinct pressure faces; common medium seams and masses of gypsum; slightly effervescent; mildly alkaline.

The thickness of the solum is 18 to 36 inches. The depth to soft bedrock is 20 to 40 inches. The depth to carbonates is 0 to 10 inches. Some pedons are saline.

The A horizon has hue of 10YR or 2.5Y and value of 4 or 5 (3 or 4 moist). The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is silty clay or clay. The Cr horizon has hue of 5Y or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 4.

Parshall Series

The Parshall series consists of deep, well drained and moderately well drained, moderately rapidly permeable soils on terraces and uplands. These soils formed in alluvium. Slope is 1 to 9 percent.

Typical pedon of Parshall fine sandy loam, 1 to 6 percent slopes, 2,300 feet west and 2,420 feet north of the southeast corner of sec. 13, T. 132 N., R. 93 W.

A—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and many very fine roots; neutral; clear smooth boundary.

Bw1—10 to 19 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few fine and many very fine roots; neutral; gradual wavy boundary.

Bw2—19 to 43 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; common very fine roots; mildly alkaline; clear wavy boundary.

Bk—43 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; soft, very friable, nonsticky and nonplastic; common very fine roots; few fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 16 to 43 inches. The thickness of the solum is 27 to 60 inches or more. The depth to carbonates is 22 to 60 inches. Some pedons are saline.

The A horizon has value of 3 or 4 (2 or 3 moist). It is loam or fine sandy loam. The Bw horizon has value of 4 to 6 (2 to 5 moist) and chroma of 2 or 3. It is fine sandy loam, sandy loam, or loam.

Reeder Series

The Reeder series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 6 percent.

Typical pedon of Reeder loam, 1 to 3 percent slopes, 600 feet south and 750 feet west of the northeast corner of sec. 6, T. 136 N., R. 94 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, sticky and plastic; common very fine and few fine roots; common distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt2—10 to 19 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common very fine roots; common distinct clay films on faces of peds; mildly alkaline; gradual wavy boundary.

Bk—19 to 26 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common fine and medium irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Cr—26 to 60 inches; light gray (5Y 7/2), soft siltstone, olive gray (5Y 5/2) moist; few very fine roots; common fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

The thickness of the mollic epipedon is 9 to 15 inches. The thickness of the solum is 24 to 30 inches. The depth to soft bedrock is 20 to 40 inches. The depth to carbonates is 15 to 27 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. The Bk horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 to 4. It is silt loam, loam, silty clay loam, or clay loam. The Cr horizon has hue of 2.5Y or 5Y and value of 6 or 7. It is soft mudstone or siltstone.

Regan Series

The Regan series consists of deep, poorly drained, moderately permeable, highly calcareous, saline soils on uplands. These soils formed in alluvium. Slope is 0 to 3 percent.

The Regan soils in this county contain more sand and less silt than is definitive for the Regan series. This difference, however, does not alter the usefulness or behavior of the soils.

Typical pedon of Regan loam, 0 to 3 percent slopes, 2,600 feet east and 700 feet south of the northwest corner of sec. 4, T. 133 N., R. 91 W.

A—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; few fine salt flecks; slightly effervescent; mildly alkaline; clear wavy boundary.

Bkg1—8 to 15 inches; light gray (5Y 7/1) loam, gray (5Y 5/1) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; disseminated lime

throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—15 to 34 inches; white (5Y 8/1) loam, light gray (5Y 6/1) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; disseminated lime throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

C—34 to 60 inches; pale yellow (2.5Y 7/4) loam, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few snail shell fragments; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 10 inches. The A horizon has value of 4 or 5 (2 or 3 moist). Some pedons have an ABk horizon. The Bkg horizon has hue of 2.5Y or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 1 to 4. It is loam, clay loam, or silty clay loam. The C horizon has hue of 2.5Y or 5Y. It is stratified loam, sandy clay loam, clay loam, loamy fine sand, silty clay, or clay. Some pedons have few to many mottles in the B and C horizons. Some pedons have few to many masses of gypsum in the B and C horizons.

Regent Series

The Regent series consists of moderately deep, well drained, slowly permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 9 percent.

Typical pedon of Regent silty clay loam, 1 to 3 percent slopes, 1,835 feet north and 120 feet west of the southeast corner of sec. 20, T. 136 N., R. 95 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; neutral; clear smooth boundary.

Bt—7 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and plastic; common very fine roots; common faint clay films on faces of peds; tongues of A horizon about 0.5 inch wide; mildly alkaline; clear wavy boundary.

Bk1—13 to 22 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, sticky and plastic; common very fine roots; common fine irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bk2—22 to 32 inches; light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/4) silty clay loam, dark grayish brown (2.5Y 4/2) and light olive brown (2.5Y 5/4) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; common very fine roots; many fine irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

Cr—32 to 60 inches; light yellowish brown (2.5Y 6/4), pale olive (5Y 6/3), and brownish yellow (10YR 6/6), soft shale, light olive brown (2.5Y 5/4), olive (5Y 5/3), and yellowish brown (10YR 5/6) moist; few very fine roots; many fine seams of gypsum; common fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 16 inches. The thickness of the solum is 25 to 38 inches. The depth to soft bedrock is 20 to 40 inches. The depth to carbonates is 10 to 22 inches.

The Bt horizon has hue of 2.5Y or 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is silty clay, clay, or silty clay loam. The Bk horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is silt loam, clay loam, silty clay loam, or silty clay.

Rhoades Series

The Rhoades series consists of deep, well drained and moderately well drained, very slowly permeable, alkali soils on terraces and uplands. These soils formed in alluvium and material weathered from soft bedrock. Slope is 1 to 6 percent.

Typical pedon of a Rhoades loam in an area of Daglum-Rhoades loams, 1 to 6 percent slopes, 1,990 feet north and 2,000 feet west of the southeast corner of sec. 26, T. 133 N., R. 92 W.

E—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; light gray (10YR 6/1) coatings on faces of peds; slightly acid; abrupt smooth boundary.

Bt—2 to 9 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong

medium columnar structure parting to strong fine angular blocky; extremely hard, very firm, very sticky and very plastic; many very fine roots along faces of peds; many distinct clay films on vertical faces of peds; light gray (10YR 6/1) coatings on top of columns; mildly alkaline; clear smooth boundary.

Btkz—9 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine and medium angular and subangular blocky structure; extremely hard, very firm, very sticky and very plastic; many very fine roots along faces of peds; common distinct clay films on faces of peds; common fine flecks of salts; common fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bkz—13 to 18 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; strong fine and medium angular and subangular blocky structure; extremely hard, very firm, very sticky and very plastic; many very fine roots along faces of peds; common fine flecks of salts; common fine irregularly shaped soft masses of lime; strongly effervescent; strongly alkaline; clear smooth boundary.

Bky1—18 to 27 inches; pale yellow (2.5Y 7/4) silty clay, light yellowish brown (2.5Y 6/4) moist; moderate medium and coarse subangular blocky structure; hard, very firm, very sticky and very plastic; common very fine roots; common fine masses of gypsum; common fine and medium irregularly shaped soft masses of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

Bky2—27 to 54 inches; light gray (5Y 7/2) silty clay, olive gray (5Y 5/2) moist; few fine distinct light olive brown (2.5Y 5/6 moist) mottles; weak medium and coarse subangular blocky structure; hard, very firm, very sticky and very plastic; common very fine roots; common fine gypsum crystals; disseminated lime throughout; strongly effervescent; strongly alkaline; clear irregular boundary.

Cr—54 to 60 inches; light gray (5Y 7/2), soft shale, olive gray (5Y 5/2) moist; few fine distinct light olive brown (2.5Y 5/6 moist) mottles; few fine gypsum crystals; strongly effervescent; moderately alkaline.

The thickness of the solum is 40 to 54 inches. The depth to carbonates is 9 to 15 inches. The depth to soft bedrock is 40 to 60 inches or more. Some pedons are saline.

Some pedons have an A horizon 1 to 3 inches thick. The Bt horizon has hue of 10YR or 2.5Y and value of 4 or 5 (3 or 4 moist). It is clay, silty clay, silty clay loam, or clay loam. Some pedons have a C horizon that has hue of 5Y or 2.5Y and chroma of 2 or 3.

Ruso Series

The Ruso series consists of deep, well drained soils on terraces. These soils formed in alluvium. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slope is 1 to 6 percent.

Typical pedon of Ruso fine sandy loam, 1 to 6 percent slopes, 100 feet south and 100 feet west of the northeast corner of sec. 8, T. 133 N., R. 92 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; neutral; abrupt smooth boundary.

Bw1—6 to 13 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; neutral; gradual wavy boundary.

Bw2—13 to 30 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; common very fine roots; about 5 percent gravel; neutral; clear wavy boundary.

2C—30 to 60 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; about 15 percent gravel; accumulations of lime on the underside of pebbles; strongly effervescent; mildly alkaline.

The thickness of the mollic epipedon is 16 to 30 inches. The depth to carbonates is 20 to 34 inches.

The A horizon has value of 4 or 5. The Bw horizon has value of 3 or 4 moist and chroma of 2 to 4. The 2C horizon is loamy sand, sand, gravelly loamy sand, gravelly sand, or very gravelly loamy sand.

Savage Series

The Savage series consists of deep, well drained, slowly permeable soils on terraces and uplands. These soils formed in alluvium. Slope is 1 to 15 percent.

Typical pedon of Savage clay loam, 3 to 6 percent

slopes (fig. 12), 280 feet south and 395 feet east of the northwest corner of sec. 13, T. 132 N., R. 92 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; neutral; abrupt smooth boundary.

A—5 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to moderate very fine and fine granular; hard, firm, slightly sticky and slightly plastic; many very fine roots; neutral; clear wavy boundary.

Bt1—7 to 11 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate very fine subangular blocky; slightly hard, friable, very sticky and very plastic; many very fine roots; many faint clay films on faces of peds; neutral; clear wavy boundary.

Bt2—11 to 18 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate very fine subangular blocky; hard, firm, very sticky and very plastic; common very fine roots; common distinct clay films on faces of peds; mildly alkaline; gradual wavy boundary.

Bt3—18 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak very fine and fine subangular blocky; hard, firm, very sticky and very plastic; common very fine roots; common distinct clay films on faces of peds; mildly alkaline; abrupt smooth boundary.

Bk1—25 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; hard, firm, sticky and plastic; common very fine roots; very few distinct clay films on faces of peds; common medium irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—36 to 51 inches; pale olive (5Y 6/3) silty clay loam, olive (5Y 5/3) moist; massive; very hard, very firm, very sticky and very plastic; few very fine roots; very few lignite channers; few fine irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C—51 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; very hard, very firm, sticky and plastic; about 1 percent shale channers; strongly effervescent; moderately alkaline.

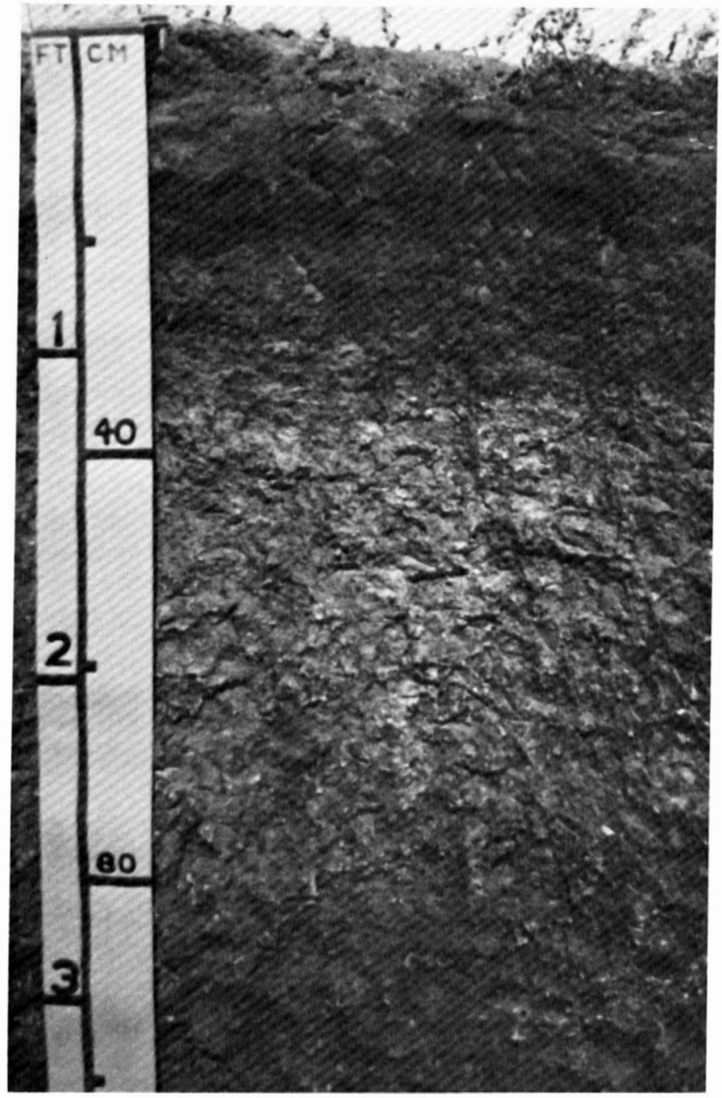

Figure 12.—Typical profile of Savage clay loam, 3 to 6 percent slopes, showing the dark-colored surface layer and upper part of the subsoil. The light color of the lower part of the subsoil is a result of an accumulation of lime.

The thickness of the mollic epipedon is 8 to 16 inches. The thickness of the solum is 25 to 60 inches. The depth to carbonates is 13 to 41 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). The Bt horizon has chroma of 2 to 4. It is clay, silty clay loam, silty clay, or clay loam. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is clay loam, silty clay loam, or silty clay. A few pedons are

stratified with coarser textured material. Some pedons have salts below a depth of 51 inches.

Shambo Series

The Shambo series consists of deep, well drained, moderately permeable soils on terraces and uplands. These soils formed in alluvium. Slope is 1 to 15 percent.

Typical pedon of Shambo loam, 1 to 3 percent slopes, 2,200 feet east and 300 feet north of the southwest corner of sec. 32, T. 134 N., R. 92 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; neutral; abrupt smooth boundary.

Bw1—6 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; many very fine roots; few pebbles; neutral; clear wavy boundary.

Bw2—12 to 18 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; common very fine roots; neutral; clear wavy boundary.

Bk1—18 to 30 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak fine subangular blocky; soft, very friable, slightly sticky and slightly plastic; few very fine roots; few fine irregularly shaped soft masses of lime; slightly effervescent; mildly alkaline; gradual wavy boundary.

Bk2—30 to 45 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure; slightly hard, firm, sticky and plastic; few very fine roots; many medium irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C—45 to 60 inches; pale yellow (2.5Y 7/4) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, sticky and plastic; disseminated lime throughout; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 15 inches. The thickness of the solum is 33 to 51 inches. The depth to carbonates is 17 to 28 inches.

The A horizon has value of 3 to 5 (2 or 3 moist). The Bw horizon has chroma of 2 to 4. The Bk horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is loam, fine sandy loam, sandy loam, clay loam, or gravelly loam.

Sinnigam Series

The Sinnigam series consists of shallow, well drained, moderately slowly permeable soils on uplands. These soils formed in material weathered from hard bedrock. Slope is 1 to 6 percent.

Typical pedon of a Sinnigam loam in an area of Sinnigam-Daglum complex, 1 to 25 percent slopes, 1,170 feet east and 500 feet south of the northwest corner of sec. 5, T. 133 N., R. 94 W.

A—0 to 5 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; about 5 percent silcrete channers; neutral; clear wavy boundary.

Bt—5 to 13 inches; brown (7.5YR 5/2) flaggy clay loam, dark brown (7.5YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; common very fine roots; common distinct clay films on faces of peds; about 35 percent silcrete flagstones; neutral; clear wavy boundary.

Bw—13 to 17 inches; pale brown (10YR 6/3) very flaggy clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few very fine roots in the upper part; about 50 percent silcrete flagstones; neutral; gradual wavy boundary.

R—17 inches; silcrete; pale brown clay coatings on some surfaces.

The depth to hard bedrock is 10 to 20 inches. The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 to 4. The A horizon is 5 to 30 percent channers, flagstones, or cobbles. The Bt horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 6. The Bt horizon is 35 to 50 percent channers, flagstones, or cobbles. The Bw horizon is 35 to 60 percent channers, flagstones, or cobbles.

Straw Series

The Straw series consists of deep, well drained,

moderately permeable soils on flood plains and low terraces. These soils formed in alluvium. Slope is 0 to 3 percent.

Typical pedon of Straw loam, channeled, 1,800 feet west and 30 feet south of the northeast corner of sec. 10, T. 136 N., R. 94 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; clear wavy boundary.

A1—5 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; clear wavy boundary.

A2—10 to 23 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; mildly alkaline; clear wavy boundary.

A3—23 to 30 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; disseminated lime throughout; slightly effervescent; moderately alkaline; gradual wavy boundary.

C—30 to 36 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; very hard, firm, sticky and plastic; common very fine roots, few pebbles; few fine and medium rounded soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Ab—36 to 40 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common fine and medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C'—40 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; very hard, firm, sticky and plastic; few very fine roots; few fine and medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 16 to 32 inches. The depth to carbonates is 7 to 33 inches.

The A horizon has value of 2 to 4 moist. Some pedons have a B horizon that is loam, silt loam, or clay loam. The C horizon has hue of 2.5Y or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is clay loam, silt loam, loam, or fine sandy loam. In a few pedons it is stratified with coarser or finer textured material.

Vebar Series

The Vebar series consists of moderately deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 1 to 20 percent.

Typical pedon of a Vebar fine sandy loam in an area of Vebar-Parshall fine sandy loams, 1 to 6 percent slopes, 1,485 feet east and 415 feet south of the northwest corner of sec. 7, T. 135 N., R. 95 W.

Ap—0 to 6 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; neutral; abrupt smooth boundary.

Bw—6 to 20 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; mildly alkaline; clear smooth boundary.

Bk—20 to 32 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common medium soft masses of lime; strongly effervescent; moderately alkaline; clear irregular boundary.

Cr—32 to 60 inches; light gray (2.5Y 7/2), soft sandstone, light brownish gray (2.5Y 6/2) moist; few very fine roots in weathered zones; common fine soft masses of lime in fractures; slightly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 7 to 16 inches. The depth to soft bedrock is 29 to 37 inches. The depth to carbonates is 12 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bw horizon has value of 5 or 6 (3 or 4 moist). It is sandy loam, fine sandy loam, or loam. The Bk horizon has hue of 10YR or 2.5Y, value of 5 to

7 (4 to 6 moist), and chroma of 2 to 4. It is sandy loam or fine sandy loam.

Velva Series

The Velva series consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 3 percent.

The Velva soils in this county do not have a mollic epipedon, which is definitive for the Velva series. This difference, however, does not alter the usefulness or behavior of the soils.

Typical pedon of Velva fine sandy loam, 0 to 3 percent slopes, 1,875 feet west and 30 feet south of the northeast corner of sec. 12, T. 133 N., R. 91 W.

A—0 to 5 inches; stratified grayish brown (10YR 5/2) and brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; mildly alkaline; abrupt smooth boundary.

C1—5 to 11 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

C2—11 to 16 inches; light brownish gray (2.5Y 6/2), stratified fine sandy loam and loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine soft filaments of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—16 to 39 inches; light yellowish brown (2.5Y 6/4) fine sandy loam, light olive brown (2.5Y 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C4—39 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; slightly effervescent; moderately alkaline.

The depth to carbonates is 0 to 7 inches. The A horizon has value of 4 or 5. The C horizon has hue of 2.5Y or 10YR and chroma of 2 to 4. It is fine sandy loam or thinly stratified fine sandy loam, loam, and silt loam. Some pedons have an Ab horizon.

Watrous Series

The Watrous series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from hard bedrock. Slope is 1 to 6 percent.

Typical pedon of a Watrous loam in an area of Watrous-Felor loams, 1 to 6 percent slopes, 760 feet east and 550 feet south of the northwest corner of sec. 16, T. 136 N., R. 93 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; abrupt smooth boundary.

A—6 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; mildly alkaline; clear wavy boundary.

Bt—12 to 20 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, sticky and plastic; common very fine and fine roots; common distinct clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btk—20 to 24 inches; light brownish gray (2.5Y 6/2) channery clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and slightly plastic; common very fine and fine roots; few faint clay films on faces of peds; about 20 percent limestone channers; common fine and medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

R—24 inches; white (5Y 8/1) limestone; vertical fractures more than 2 feet apart; roots matted at contact with rock; brown (10YR 5/3), fine textured soil material filling some fracture voids; strongly effervescent; moderately alkaline.

The thickness of the mollic epipedon is 10 to 16

inches. The depth to hard bedrock is 20 to 40 inches.

The A horizon has value of 4 or 5. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is loam or clay loam.

Wayden Series

The Wayden series consists of shallow, well drained, slowly permeable soils on uplands. These soils formed in material weathered from soft bedrock. Slope is 2 to 9 percent.

Typical pedon of Wayden silty clay, 2 to 9 percent slopes, 1,300 feet west and 2,200 feet south of the northeast corner of sec. 30, T. 136 N., R. 95 W.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; hard, firm, very sticky and plastic; common very fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

AC—4 to 12 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, very sticky and plastic; common very fine roots; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—12 to 16 inches; light gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; massive; hard, firm, very sticky and very plastic; common very fine roots; about 10 percent shale channers; common fine irregularly shaped soft masses of gypsum; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cr—16 to 60 inches; gray (5Y 6/1), soft shale, dark gray (5Y 4/1) moist; few very fine roots following fractures; common medium brown (10YR 4/3 moist) stains on shale fragments; few fine and medium masses of gypsum; slightly effervescent; moderately alkaline.

The depth to soft bedrock is 10 to 20 inches. The A horizon has hue of 2.5Y or 5Y and value of 5 or 6 (3 or 4 moist). The C horizon has hue of 5Y or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 1 to 4. It is silty clay or clay. In some pedons the Cr horizon has thin layers of lignite.

Yegen Series

The Yegen series consists of deep, well drained, moderately permeable soils on terraces and uplands. These soils formed in alluvium and material weathered from soft bedrock. Slope is 1 to 6 percent.

Typical pedon of Yegen fine sandy loam, 1 to 6 percent slopes, 3,500 feet north and 3,050 feet east of the southwest corner of sec. 7, T. 136 N., R. 94 W.

Ap—0 to 7 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; neutral; abrupt smooth boundary.

Bt—7 to 19 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate coarse prismatic structure parting to strong medium subangular blocky; hard, friable, sticky and plastic; common very fine roots; many faint clay films on faces of peds; neutral; gradual wavy boundary.

Bw—19 to 27 inches; olive yellow (2.5Y 6/6) loam, light olive brown (2.5Y 5/6) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and plastic; few very fine roots; mildly alkaline; abrupt wavy boundary.

C1—27 to 43 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; mildly alkaline; gradual wavy boundary.

C2—43 to 60 inches; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; moderately alkaline.

The thickness of the mollic epipedon is 7 to 15 inches. The thickness of the solum is 23 to 53 inches. The depth to carbonates is 20 to 60 inches or more.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 3 to 5 (2 to 4 moist). It is sandy clay loam, clay loam, or loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 6. It is fine sandy loam, sandy loam, loamy sand, or loam.

Formation of the Soils

Soil forms through the physical and chemical weathering of deposited or accumulated geologic material. Soil characteristics are determined by (1) the physical traits and chemical and mineralogical composition of the parent material; (2) the climate under which the soil formed and has existed during formation; (3) the plant and animal life on and in the soil; (4) the relief; and (5) the length of time that the processes of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are very influential factors of soil formation. They determine the nature of weathering and slowly change the parent material into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by the relief and the parent material. Finally, time is needed in order for the climatic and biological forces to weather the parent material and form a soil. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

One of the most important physical properties of parent material is its texture. In most cases the texture of the parent material determines the texture of the soil, which is an important factor in the use and management of the soil. Other properties of the parent material also can have an important effect on soil formation. Soils that have a dense, alkali subsoil, such as those of the Rhoades and Daglum series, generally formed in parent material that contained large quantities of sodium salts.

The parent material of the soils in Hettinger County have several different origins. The most extensive parent material weathered from soft residual bedrock of the Tertiary Period. The major geological material exposed in the county is that of the Fort Union Group of the Paleocene Epoch. This group is subdivided into the Slope, Bullion Creek, and Sentinel Butte Formations.

Other geological material exposed in the northern part of the county includes the White River Formation of the Oligocene Epoch and the Golden Valley Formation of the Eocene and Paleocene Epochs *(8)*. The exposed bedrock in Hettinger County is of continental origin. It consists of sediment deposited by wind and water on the land and in freshwater lakes. The unexposed, deeper material is marine sediment originally deposited in shallow saltwater seas. There are small areas of windblown Holocene sand deposits and several Quaternary terraces along major streams. Silcrete stones commonly are on ridges and hills, and deposits of silicified wood are on many terraces. The Fort Union Group consists of stratified layers of soft sandstone, siltstone, shale, and lignite. Soils of the Amor, Cabba, Flasher, Reeder, Regent, Vebar, and Wayden series are some that developed in material from this group of formations.

The White River Formation is the youngest residual deposit in the county. White Butte, Bull Butte, and other buttes in the north-central part of the county are capped with this formation *(9)*. It consists of siltstone, limestone, and shale. Watrous and Felor soils developed in this material. The Golden Valley Formation is present in the northwestern part of the county. Its Bear Den member generally is high in kaolinitic clay and in places has yellow and purple stains. Lefor soils developed in this sediment. Soils that formed in local alluvial sediment on residual uplands are those of the Savage, Grail, Lawther, Shambo, Arnegard, and Parshall series.

The parent material of the soils on the flood plains and terraces is alluvium deposited by the floodwater of streams. These soils are stratified, and some have old buried surface layers or deposits of sand and gravel. Soils of the Korchea, Velva, Straw, Bowdle, Lehr, and Ruso series are examples of those that formed on flood plains and terraces. In a few areas the soils formed in porcellanite, locally called scoria. The porcellanite was formed by the burning of lignite veins that baked the surrounding material. The resulting red rock, which is

resistant to weathering, is a source of local road surfacing material. Soils of the Brandenburg series are an example of those that formed in that material. The lignite beds of the various geological members have contributed little to the characteristics of any particular soil.

The dense, alkali subsoil of the Rhoades, Daglum, Heil, and Harriet soils was formed when excess sodium salts were removed from the upper part of the soil profile. This resulted in the leaching of clay and organic matter and the formation of a platy, gray subsurface layer. As the leaching process continues, a dense clay- and sodium-rich subsoil is formed by the movement and redeposition of the leached clay and organic matter.

Climate

Climate is perhaps the most influential factor in soil formation. Climatic factors include air and soil temperature, precipitation, intensity and duration of storms, number of frost-free days, and length of the growing season. Climate provides the total amount of energy available for the formation of soils. The effect of climate on soil formation is modified by relief.

The physical and chemical processes of weathering of the parent material, as well as biological activities in the soil, are influenced by climate. The processes of soil formation are most active if the climate is warm and moist. Climate influences these processes to a large extent by the effect it has on vegetation. Hettinger County has a continental, semiarid climate characterized by long, cold winters and short, warm summers. Most of the precipitation falls during the growing season, but its distribution may be erratic. This climate favors the growth of mid and short grasses.

Moisture and temperature directly affect the weathering processes in the parent material. They also affect the leaching and redistribution of carbonates and clay particles and the accumulation of organic matter in the soil profile. Freezing and thawing help to break down soil particles in the parent material, thereby providing more surface area for chemical processes. The cold and semiarid climate prevents deep leaching and extensive chemical weathering. It also limits the production of vegetation, but it does allow organic matter and bases to accumulate in the soil.

The Amor, Reeder, Regent, Shambo, and Savage soils are leached of carbonates to an average depth of less than 20 inches. Alternate wetting and drying and freezing and thawing have aided in the formation of prismatic and blocky soil structure in the subsoil of these soils.

Some soils in Hettinger County exhibit evidence of freezing during the Pleistocene Epoch *(6)*. This evidence is the ice wedge polygons that formed when the ground was permanently frozen. The polygonal patterns of the ice wedges are evident in the Shambo soils on terraces in some areas in the county. The plants on the Shambo soils that have relict ice wedge polygons in places exhibit the same alternate tall and short growth pattern typical of sodium-affected soils, such as those of the Belfield and Daglum series.

Plant and Animal Life

Plants have significantly influenced the formation of soils in Hettinger County. Earthworms, small animals, and micro-organisms are also important, but to a lesser extent. The native vegetation consists mostly of mid and short grasses. The composition of these grasses varies from site to site. In swales, which receive additional moisture, the dominant species are green needlegrass, western wheatgrass, and big bluestem. On well drained uplands, the common native species include needleandthread and blue grama. Little bluestem and prairie sandreed are dominant on many shallow soils. The species in poorly drained areas include prairie cordgrass, slough sedge, switchgrass, and saltgrass.

The native vegetation produced a large amount of organic matter that decayed and was incorporated into the soil. Organic matter accumulated in soils such as those of the Arnegard, Parshall, and Grail series. The plant roots provide a means whereby nutrients that have been leached into the lower part of the soil are recycled to the surface and left when the plant decays. Bacteria and other micro-organisms aid in the formation of humus by breaking down plant and animal remains. Plant roots also act, both physically and chemically, as agents in weathering the parent material.

Man's activities have had an important influence on soils in Hettinger County. Tillage, drainage, fertilizing, and changing the kinds of vegetation have altered the original nature of some of the soils.

Relief

Relief, or the lay of the land, influences soil formation mainly by controlling the movement of water and effective microclimates. The effects of relief are modified by the four other factors of soil formation, especially climate and vegetation. The relief of Hettinger County was shaped by the natural process of erosion. Meltwater from Pleistocene glaciation further to the

north and east greatly influenced the relief.

The profile of soils that formed in depressions differs from that of soils that formed in steeply sloping areas. The Heil and Dimmick soils, which formed in depressions where runoff accumulates, exhibit an advanced degree of horizonation and soil mottling because of the alternate wetting and drying cycles that occur in depressions. The soils that formed in swales that receive runoff from surrounding slopes, such as those of the Arnegard series, have a thick surface layer with abundant organic matter. The abundant organic matter resulted from the additional moisture and the resultant luxuriant plant growth. Gently sloping soils, such as those of the Shambo and Savage series, generally support more abundant plant growth than do steeply sloping soils. Their horizonation is well developed, and lime has been leached to a greater depth. The steeply sloping soils, such as those of the Cabba and Flasher series, exhibit a minimal degree of horizonation, have lime close to the surface, and are low in content of organic matter. Surface runoff is probably the most controlling factor in the formation of the steep and excessively drained soils. The droughtiness of these soils results in less plant cover and a high rate of runoff results in continued erosion; therefore, soil development is restricted.

Time

Time is necessary for the factors of soil formation to act on parent material. The length of time needed for a particular soil to develop depends on parent material, relief, climate, and plant and animal life. The formation of a soil generally is a very slow process.

The soils in Hettinger County range from mature soils that have well developed profile characteristics to young soils that have little or no horizonation or profile development. Soils on flood plains, such as those of the Velva and Korchea series, are young because fresh material is periodically added at the surface and not enough time elapses between additional deposits for the formation of distinct horizons. The gently sloping soils of the uplands are older than those of the flood plains. The older soils have well-defined horizons and distinct structure in the subsoil. The Regent and Yegen soils are examples of older soils. The oldest soils in the county are those on the flat tops of isolated buttes. These soils are very well developed. They exhibit distinct horizonation, and lime has been leached to a great depth. Felor soils are an example.

The parent material from which the soils of Hettinger County formed was deposited as much as 60 million years ago, but most soil material evident today is less than 30,000 years old.

The effect of time is often modified by human activity. In some cases tillage causes accelerated erosion that in turn causes a reduction in the amount of organic matter in the surface layer. Other human activities, such as drainage, can cause an accumulation of salts in the soil.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains

much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Clinker. A rough, jagged fragment that resembles the clinker, or slag, of a furnace. A byproduct of burning coal veins.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are

free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true

soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or

other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mudstone. A blocky or massive, fine-grained sedimentary rock that consists of a mixture of clay, silt, and sand particles, the proportions of which vary from place to place.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil

changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Porcellanite (scoria). Shale and clay that are fused as a result of their proximity to a burning coal vein.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root shearing. The cutting, tearing, and disruption of plant roots caused by animals grazing when the soil is wet and soft.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Scab spot. A small area of soil that has a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Scoria. See porcellanite.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils

of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silcrete. A hard siltstone that is cemented with silica.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are—

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates

longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Generally, the E horizon. If this horizon is at the surface, it is called a surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. An A horizon 4 to 9 inches thick. Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. An A horizon 10 inches thick or more.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Mott, North Dakota)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	23.3	-1.0	11.2	53	-35	15	0.38	0.19	0.54	2	5.4
February----	30.1	6.4	18.3	60	-29	16	.38	.09	.61	1	5.1
March-------	39.4	15.6	27.5	75	-21	52	.57	.19	.88	2	5.3
April-------	55.0	28.7	41.9	86	6	155	1.63	.53	2.54	4	2.4
May---------	67.3	40.2	53.8	92	20	428	2.51	1.15	3.67	6	1.1
June--------	75.7	50.1	62.9	96	34	687	3.82	1.92	5.47	8	.0
July--------	83.5	54.9	69.2	102	41	905	2.02	.90	2.96	5	.0
August------	82.5	52.8	67.7	101	36	859	1.84	.64	2.82	4	.0
September---	71.4	41.7	56.6	98	22	498	1.41	.49	2.17	4	.1
October-----	60.1	30.9	45.5	87	10	210	.69	.15	1.11	2	1.2
November----	41.5	16.6	29.1	72	-12	28	.47	.06	.77	2	4.5
December----	29.8	5.9	17.9	58	-29	18	.36	.08	.57	2	5.2
Yearly:											
Average---	55.0	28.7	41.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	103	-35	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,871	16.08	12.82	19.18	42	30.3

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Mott, North Dakota)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 19	May 25	June 11
2 years in 10 later than--	May 13	May 20	June 5
5 years in 10 later than--	May 1	May 12	May 25
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 16	Sept. 6	Aug. 31
2 years in 10 earlier than--	Sept. 22	Sept. 11	Sept. 5
5 years in 10 earlier than--	Oct. 4	Sept. 21	Sept. 13

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Mott, North Dakota)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	130	114	91
8 years in 10	139	120	98
5 years in 10	155	131	111
2 years in 10	170	142	125
1 year in 10	179	148	132

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Heil silty clay loam	4,090	0.6
3	Dimmick silty clay	1,640	0.2
4	Grail clay loam, 1 to 3 percent slopes	5,790	0.8
5C	Wayden silty clay, 2 to 9 percent slopes	2,240	0.3
6B	Vebar-Parshall fine sandy loams, 1 to 6 percent slopes	25,950	3.6
7C	Vebar-Flasher fine sandy loams, 3 to 9 percent slopes	35,700	5.0
7D	Vebar-Flasher complex, 9 to 20 percent slopes	22,470	3.1
8	Belfield-Daglum clay loams, 1 to 3 percent slopes	41,000	5.7
8B	Belfield-Daglum clay loams, 3 to 6 percent slopes	19,380	2.7
9	Regent silty clay loam, 1 to 3 percent slopes	7,830	1.1
9B	Regent silty clay loam, 3 to 6 percent slopes	37,570	5.2
9C	Regent-Cabba complex, 6 to 9 percent slopes	15,170	2.1
10B	Beisigl-Lihen loamy fine sands, 1 to 6 percent slopes	9,640	1.3
11	Moreau silty clay, 1 to 3 percent slopes	7,160	1.0
11B	Moreau silty clay, 3 to 6 percent slopes	25,340	3.5
12B	Daglum-Rhoades loams, 1 to 6 percent slopes	18,280	2.5
13	Lawther silty clay, 1 to 3 percent slopes	10,230	1.4
14B	Parshall fine sandy loam, 1 to 6 percent slopes	15,480	2.1
15	Arnegard loam, 1 to 3 percent slopes	8,230	1.1
16	Shambo loam, 1 to 3 percent slopes	11,710	1.6
16B	Shambo loam, 3 to 6 percent slopes	11,020	1.5
17	Chama silt loam, 1 to 3 percent slopes	1,400	0.2
17B	Chama silt loam, 3 to 6 percent slopes	28,250	3.9
17C	Chama-Cabba silt loams, 6 to 9 percent slopes	21,200	2.9
18	Amor loam, 1 to 3 percent slopes	3,580	0.5
18B	Amor loam, 3 to 6 percent slopes	25,540	3.5
18C	Amor-Cabba loams, 6 to 9 percent slopes	26,970	3.7
18D	Amor-Cabba loams, 9 to 15 percent slopes	19,810	2.7
19F	Cabba-Chama silt loams, 15 to 70 percent slopes	6,150	0.8
20F	Flasher-Beisigl-Parshall complex, 6 to 70 percent slopes, extremely stony	5,970	0.8
21B	Ruso fine sandy loam, 1 to 6 percent slopes	8,820	1.2
22	Bowdle loam, 0 to 3 percent slopes	7,260	1.0
22B	Bowdle loam, 3 to 6 percent slopes	2,180	0.3
24	Straw loam, 0 to 3 percent slopes	2,160	0.3
25B	Lihen loamy fine sand, 1 to 6 percent slopes	3,700	0.5
26	Regan loam, 0 to 3 percent slopes	6,800	0.9
27E	Sinnigam-Daglum complex, 1 to 25 percent slopes	2,130	0.3
28	Harriet loam	11,160	1.5
29	Korchea loam, 0 to 3 percent slopes	6,570	0.9
30	Straw loam, channeled	18,880	2.6
33	Savage clay loam, 1 to 3 percent slopes	15,970	2.2
33B	Savage clay loam, 3 to 6 percent slopes	32,390	4.5
34F	Brandenburg-Cabba-Savage complex, 6 to 70 percent slopes	1,770	0.2
35F	Cabba-Amor-Savage complex, 9 to 70 percent slopes, extremely stony	8,330	1.1
36	Velva fine sandy loam, 0 to 3 percent slopes	2,080	0.3
38	Belfield-Grail clay loams, 0 to 3 percent slopes	33,020	4.5
39	Belfield-Grail clay loams, saline, 0 to 3 percent slopes	6,700	0.9
40	Dumps-Pits complex	540	0.1
41B	Ekalaka fine sandy loam, 1 to 6 percent slopes	1,550	0.2
42B	Felor loam, terrace, 1 to 6 percent slopes	3,240	0.4
43	Lefor fine sandy loam, 0 to 3 percent slopes	1,570	0.2
43B	Lefor fine sandy loam, 3 to 6 percent slopes	1,240	0.2
44	Reeder loam, 1 to 3 percent slopes	3,610	0.5
44B	Reeder loam, 3 to 6 percent slopes	12,260	1.7
45B	Felor loam, 1 to 6 percent slopes	2,010	0.3
46	Parshall loam, moderately wet, 1 to 3 percent slopes	1,920	0.3
47	Regent-Daglum complex, 1 to 3 percent slopes	3,440	0.5
47B	Regent-Daglum complex, 3 to 6 percent slopes	10,180	1.4
48F	Lehr-Shambo-Cabba loams, 6 to 50 percent slopes	6,320	0.9
49B	Watrous-Felor loams, 1 to 6 percent slopes	1,680	0.2
50B	Yegen fine sandy loam, 1 to 6 percent slopes	12,130	1.7
52B	Parshall fine sandy loam, terrace, 1 to 6 percent slopes	6,550	0.9
53B	Lehr-Bowdle loams, 1 to 6 percent slopes	4,140	0.6
54	Belfield-Daglum clay loams, saline, 1 to 3 percent slopes	2,960	0.4

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
55B	Moreau silty clay, saline, 1 to 6 percent slopes	450	0.1
56	Parshall loam, saline, 1 to 3 percent slopes	760	0.1
57	Daglum-Rhoades loams, saline, 1 to 3 percent slopes	660	0.1
	Water	4,480	0.6
	Total	726,400	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS

(Yields are those that can be expected under a high level of management, except the undrained yield is given for poorly drained and very poorly drained soils. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Spring wheat	Barley	Sunflowers	Crested wheatgrass-alfalfa hay
	Bu	Bu	Lbs	Tons
2. Heil	---	---	---	1.1
3. Dimmick	12	20	600	---
4. Grail	29	47	1,450	2.4
5C. Wayden				
6B. Vebar-Parshall	20	33	1,000	1.3
7C. Vebar-Flasher	15	24	750	1.0
7D. Vebar-Flasher	---	---	---	0.9
8. Belfield-Daglum	19	31	950	1.2
8B. Belfield-Daglum	18	29	900	1.2
9. Regent	26	42	1,300	1.4
9B. Regent	22	36	1,100	1.4
9C. Regent-Cabba	13	21	650	1.0
10B. Beisigl-Lihen	13	21	650	1.3
11. Moreau	20	33	1,000	1.6
11B. Moreau	16	26	800	1.6
12B. Daglum-Rhoades	10	16	500	0.9
13. Lawther	24	39	1,200	1.6
14B. Parshall	24	39	1,200	1.5
15. Arnegard	29	47	1,450	2.4

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Spring wheat	Barley	Sunflowers	Crested wheatgrass-alfalfa hay
	Bu	Bu	Lbs	Tons
16 Shambo	26	42	1,300	1.8
16B Shambo	24	39	1,200	1.8
17 Chama	23	37	1,150	1.4
17B Chama	20	33	1,000	1.4
17C Chama-Cabba	14	23	700	0.8
18 Amor	24	39	1,200	1.4
18B Amor	23	37	1,150	1.4
18C Amor-Cabba	15	24	750	0.8
18D Amor-Cabba	12	20	600	0.8
19F. Cabba-Chama				
20F. Flasher-Beisigl-Parshall				
21B Ruso	15	24	750	1.4
22 Bowdle	19	31	950	1.8
22B Bowdle	17	28	850	1.8
24 Straw	27	44	1,350	1.8
25B Lihen	16	26	800	1.4
26 Regan	9	15	450	1.4
27E. Sinnigam-Daglum				
28 Harriet	---	---	---	1.1
29 Korchea	26	42	1,300	1.8
30 Straw	---	---	---	2.4

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Spring wheat	Barley	Sunflowers	Crested wheatgrass-alfalfa hay
	Bu	Bu	Lbs	Tons
33----------------------- Savage	27	44	1,350	1.6
33B---------------------- Savage	23	37	1,150	1.6
34F. Brandenburg-Cabba-Savage				
35F. Cabba-Amor-Savage				
36----------------------- Velva	22	36	1,100	2.4
38----------------------- Belfield-Grail	25	41	1,250	1.8
39----------------------- Belfield-Grail	12	20	600	1.7
40*. Dumps				
41B---------------------- Ekalaka	16	26	800	1.1
42B---------------------- Felor	24	39	1,200	1.8
43 ---------------------- Lefor	19	31	950	1.3
43B --------------------- Lefor	16	26	800	1.3
44----------------------- Reeder	26	42	1,300	1.4
44B---------------------- Reeder	24	39	1,200	1.4
45B---------------------- Felor	23	37	1,150	1.8
46----------------------- Parshall	27	44	1,350	2.4
47----------------------- Regent-Daglum	20	33	1,000	1.2
47B---------------------- Regent-Daglum	18	29	900	1.2
48F. Lehr-Shambo-Cabba				
49B---------------------- Watrous-Felor	20	33	1,000	1.6

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Spring wheat	Barley	Sunflowers	Crested wheatgrass-alfalfa hay
	Bu	Bu	Lbs	Tons
50B: Yegen	21	34	1,050	1.4
52B: Parshall	20	33	1,000	1.3
53B: Lehr-Bowdle	16	26	800	1.5
54: Belfield-Daglum	10	16	500	1.1
55B: Moreau	10	16	500	1.4
56: Parshall	11	18	550	1.4
57: Daglum-Rhoades	5	8	250	0.7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
2----------------------- Heil	Closed Depression	3,000	2,600	2,200
3----------------------- Dimmick	Wetland	5,700	5,200	4,700
4----------------------- Grail	Overflow	3,400	2,900	2,400
5C---------------------- Wayden	Shallow Clay	1,200	1,000	800
6B*:				
Vebar	Sandy	2,400	2,100	1,800
Parshall	Sandy	2,400	2,100	1,800
7C*, 7D*:				
Vebar	Sandy	2,400	2,100	1,800
Flasher	Shallow	1,700	1,500	1,200
8*, 8B*:				
Belfield	Clayey	2,300	2,000	1,700
Daglum	Claypan	1,600	1,400	1,200
9, 9B------------------- Regent	Clayey	2,300	2,000	1,700
9C*:				
Regent	Clayey	2,300	2,000	1,700
Cabba	Shallow	1,700	1,500	1,200
10B*:				
Beisigl	Sands	2,500	2,300	2,000
Lihen	Sands	2,500	2,300	2,000
11, 11B----------------- Moreau	Clayey	2,300	2,000	1,700
12B*:				
Daglum	Claypan	1,600	1,400	1,200
Rhoades	Thin Claypan	900	700	500
13---------------------- Lawther	Clayey	2,300	2,000	1,700
14B--------------------- Parshall	Sandy	2,400	2,100	1,800
15---------------------- Arnegard	Overflow	3,400	2,900	2,400

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
16, 16B------------------ Shambo	Silty	2,300	2,000	1,700
17, 17B------------------ Chama	Silty	2,300	2,000	1,700
17C*:				
Chama	Silty	2,300	2,000	1,700
Cabba	Shallow	1,700	1,500	1,200
18, 18B------------------ Amor	Silty	2,300	2,000	1,700
18C*, 18D*:				
Amor	Silty	2,300	2,000	1,700
Cabba	Shallow	1,700	1,500	1,200
19F*:				
Cabba	Shallow	1,700	1,500	1,200
Chama	Silty	2,300	2,000	1,700
20F*:				
Flasher	Shallow	1,700	1,500	1,200
Beisigl	Sands	2,500	2,300	2,000
Parshall	Sandy	2,400	2,100	1,800
21B------------------ Ruso	Sandy	2,400	2,100	1,800
22, 22B------------------ Bowdle	Silty	2,300	2,000	1,700
24------------------ Straw	Silty	2,300	2,000	1,700
25B------------------ Lihen	Sands	2,500	2,300	2,000
26------------------ Regan	Subirrigated	4,400	4,000	3,600
27E*:				
Sinnigam	Shallow to Gravel	1,800	1,400	1,000
Daglum	Claypan	1,600	1,400	1,200
28------------------ Harriet	Saline Lowland	3,000	2,600	2,200
29------------------ Korchea	Silty	2,300	2,000	1,700
30------------------ Straw	Overflow	3,400	2,900	2,400

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
33, 33B Savage	Clayey	2,300	2,000	1,700
34F*:				
Brandenburg	Very Shallow	900	700	500
Cabba	Shallow	1,700	1,500	1,200
Savage	Clayey	2,300	2,000	1,700
35F*:				
Cabba	Shallow	1,700	1,500	1,200
Amor	Silty	2,300	2,000	1,700
Savage	Clayey	2,300	2,000	1,700
36 Velva	Sandy	2,400	2,100	1,800
38*:				
Belfield	Clayey	2,300	2,000	1,700
Grail	Overflow	3,400	2,900	2,400
39*:				
Belfield	Saline Lowland	3,000	2,600	2,200
Grail	Saline Lowland	3,000	2,600	2,200
41B Ekalaka	Sandy Claypan	2,700	2,000	1,300
42B Felor	Silty	2,500	2,100	1,500
43, 43B Lefor	Sandy	2,400	2,100	1,800
44, 44B Reeder	Silty	2,300	2,000	1,700
45B Felor	Silty	2,500	2,100	1,500
46 Parshall	Overflow	3,400	2,900	2,400
47*, 47B*:				
Regent	Clayey	2,300	2,000	1,700
Daglum	Claypan	1,600	1,400	1,200
48F*:				
Lehr	Shallow to Gravel	1,600	1,300	1,000
Shambo	Silty	2,300	2,000	1,700

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
48F*:				
Cabba	Shallow	1,700	1,500	1,200
49B*:				
Watrous	Silty	2,300	2,000	1,700
Felor	Silty	2,500	2,100	1,500
50B Yegen	Sandy	2,000	1,600	1,000
52B Parshall	Sandy	2,400	2,100	1,800
53B*:				
Lehr	Shallow to Gravel	1,600	1,300	1,000
Bowdle	Silty	2,300	2,000	1,700
54*:				
Belfield	Saline Lowland	3,000	2,600	2,200
Daglum	Saline Lowland	3,000	2,600	2,200
55B Moreau	Saline Lowland	3,000	2,600	2,200
56 Parshall	Saline Lowland	3,000	2,600	2,200
57*:				
Daglum	Saline Lowland	3,000	2,600	2,200
Rhoades	Saline Lowland	3,000	2,600	2,200

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
2. Heil					
3. Dimmick					
4. Grail	American plum, Tatarian honeysuckle, Peking cotoneaster.	Green ash, Black Hills spruce, Siberian crabapple, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
5C. Wayden					
6B*: Vebar.					
Parshall	Peking cotoneaster, Tatarian honeysuckle, American plum.	Black Hills spruce, Siberian crabapple, green ash, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
7C*, 7D*: Vebar.					
Flasher.					
8*, 8B*: Belfield	Siberian peashrub, golden currant, American plum, lilac.	Green ash, eastern redcedar, ponderosa pine, Rocky Mountain juniper, Russian-olive, common chokecherry.	Siberian elm	---	---
Daglum	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry.	Siberian elm, ponderosa pine.	---	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
9, 9B: Regent	Siberian peashrub, lilac, American plum, golden currant.	Ponderosa pine, green ash, Russian-olive, common chokecherry, Rocky Mountain juniper, eastern redcedar.	Siberian elm	---	---
9C*:					
Regent	Siberian peashrub, lilac, American plum, golden currant.	Ponderosa pine, green ash, Russian-olive, common chokecherry, Rocky Mountain juniper, eastern redcedar.	Siberian elm	---	---
Cabba.					
10B*:					
Beisigl	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---	---
Lihen	American plum, silver buffaloberry.	Bur oak, Siberian crabapple, Siberian peashrub, common chokecherry, Tatarian honeysuckle, eastern redcedar, lilac.	Ponderosa pine, green ash, Russian-olive.	---	---
11, 11B: Moreau	Golden currant, Siberian peashrub, lilac, American plum.	Green ash, ponderosa pine, eastern redcedar, Rocky Mountain juniper, Russian-olive, common chokecherry.	Siberian elm	---	---
12B*:					
Daglum	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry.	Siberian elm, ponderosa pine.	---	---	---
Rhoades.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
13-----------------Lawther	Golden currant, Siberian peashrub, lilac, American plum.	Green ash, ponderosa pine, Rocky Mountain juniper, Russian-olive, common chokecherry, eastern redcedar.	Siberian elm------	---	---
14B---------------Parshall	Peking cotoneaster, Tatarian honeysuckle, American plum.	Black Hills spruce, Siberian crabapple, green ash, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
15----------------Arnegard	Peking cotoneaster, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, Black Hills spruce, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
16, 16B-----------Shambo	---	Black Hills spruce, eastern redcedar, Russian-olive, Siberian peashrub, common chokecherry, lilac, Tatarian honeysuckle, American plum.	Bur oak, Siberian crabapple, green ash, ponderosa pine.	---	---
17, 17B-----------Chama	---	Black Hills spruce, eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub, American plum, common chokecherry, lilac.	Bur oak, green ash, Siberian crabapple, ponderosa pine.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
17C*:					
Chama	---	Black Hills spruce, eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub, American plum, common chokecherry, lilac.	Bur oak, green ash, Siberian crabapple, ponderosa pine.	---	---
Cabba.					
18, 18B Amor	---	Black Hills spruce, Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Bur oak, green ash, ponderosa pine, Siberian crabapple.	---	---
18C*, 18D*:					
Amor	---	Black Hills spruce, Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, American plum, lilac.	Bur oak, green ash, ponderosa pine, Siberian crabapple.	---	---
Cabba.					
19F*:					
Cabba.					
Chama.					
20F*:					
Flasher.					
Beisigl.					
Parshall	Silver buffaloberry, American plum.	Bur oak, eastern redcedar, Tatarian honeysuckle, Siberian crabapple, common chokecherry, Siberian peashrub, lilac.	Ponderosa pine, Russian-olive, green ash.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
21B---------------- Ruso	---	Ponderosa pine, Siberian peashrub, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, green ash.	---	---
22, 22B----------- Bowdle	---	Ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Siberian elm, green ash.	---	---
24---------------- Straw	---	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm------	Eastern cottonwood.
25B--------------- Lihen	American plum, silver buffaloberry.	Bur oak, Siberian crabapple, Siberian peashrub, common chokecherry, Tatarian honeysuckle, eastern redcedar, lilac.	Ponderosa pine, green ash, Russian-olive.	---	---
26---------------- Regan	Silver buffaloberry, Siberian peashrub.	---	Russian-olive, green ash, Siberian elm.	---	---
27E*: Sinnigam.					
Daglum.					
28. Harriet					
29---------------- Korchea	Peking cotoneaster, Tatarian honeysuckle, American plum.	Eastern redcedar, Siberian peashrub, green ash, Black Hills spruce, common chokecherry, Siberian crabapple.	Golden willow, ponderosa pine.	Plains cottonwood	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
30: Straw	American plum, Tatarian honeysuckle, Peking cotoneaster.	Green ash, Black Hills spruce, Siberian crabapple, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
33, 33B: Savage	---	Lilac, American elm, Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, Black Hills spruce.	Bur oak, green ash, ponderosa pine, Siberian crabapple.	---	---
34F*:					
Brandenburg.					
Cabba.					
Savage	---	Lilac, American elm, Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, Black Hills spruce.	Bur oak, green ash, ponderosa pine, Siberian crabapple.	---	---
35F*:					
Cabba.					
Amor.					
Savage	---	Lilac, American elm, Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Tatarian honeysuckle, Black Hills spruce.	Bur oak, green ash, ponderosa pine, Siberian crabapple.	---	---
36: Velva	Tatarian honeysuckle, American plum, Peking cotoneaster.	Green ash, Black Hills spruce, Siberian crabapple, Siberian peashrub, common chokecherry, eastern redcedar.	Golden willow, ponderosa pine.	Plains cottonwood	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
38*:					
Belfield	Siberian peashrub, golden currant, American plum, lilac.	Green ash, eastern redcedar, ponderosa pine, Rocky Mountain juniper, Russian-olive, common chokecherry.	Siberian elm	---	---
Grail	American plum, Tatarian honeysuckle, Peking cotoneaster.	Green ash, Black Hills spruce, Siberian crabapple, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
39*:					
Belfield	Silver buffaloberry, Siberian peashrub.	Russian-olive, green ash, Siberian elm.	---	---	---
Grail	Silver buffaloberry, Siberian peashrub.	Russian-olive, green ash, Siberian elm.	---	---	---
40*. Dumps					
41B Ekalaka	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry.	Siberian elm, ponderosa pine.	---	---	---
42B Felor	---	Eastern redcedar, Black Hills spruce, Russian-olive, Tatarian honeysuckle, common chokecherry, Siberian peashrub, American plum, lilac.	Bur oak, ponderosa pine, green ash, Siberian crabapple.	---	---
43 Lefor	American plum, silver buffaloberry.	Siberian peashrub, Tatarian honeysuckle, lilac, Siberian crabapple, eastern redcedar, common chokecherry, bur oak.	Russian-olive, green ash, ponderosa pine.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
43B: Lefor	Silver buffaloberry, American plum.	Siberian crabapple, lilac, Siberian peashrub, eastern redcedar, common chokecherry, Tatarian honeysuckle, bur oak.	Ponderosa pine, green ash, Russian-olive.	---	---
44, 44B. Reeder					
45B: Felor	---	Eastern redcedar, Black Hills spruce, Russian-olive, Tatarian honeysuckle, common chokecherry, Siberian peashrub, American plum, lilac.	Bur oak, ponderosa pine, green ash, Siberian crabapple.	---	---
46: Parshall	Peking cotoneaster, Siberian peashrub, Tatarian honeysuckle, American plum.	Siberian crabapple, green ash, Black Hills spruce, common chokecherry, eastern redcedar.	Golden willow, ponderosa pine.	Plains cottonwood	---
47*, 47B*:					
Regent	Siberian peashrub, lilac, American plum, golden currant.	Ponderosa pine, green ash, Russian-olive, common chokecherry, Rocky Mountain juniper, eastern redcedar.	Siberian elm	---	---
Daglum	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry.	Siberian elm, ponderosa pine.	---	---	---
48F*: Lehr.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
48F*:					
Shambo	---	Black Hills spruce, eastern redcedar, Russian-olive, Siberian peashrub, common chokecherry, lilac, Tatarian honeysuckle, American plum.	Bur oak, Siberian crabapple, green ash, ponderosa pine.	---	---
Cabba.					
49B*:					
Watrous	---	American plum, Black Hills spruce, Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, lilac, Tatarian honeysuckle.	Bur oak, green ash, ponderosa pine, Siberian crabapple.	---	---
Felor	---	Eastern redcedar, Black Hills spruce, Russian-olive, Tatarian honeysuckle, common chokecherry, Siberian peashrub, American plum, lilac.	Bur oak, ponderosa pine, green ash, Siberian crabapple.	---	---
50B Yegen	American plum, lilac.	Hackberry, Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Golden willow, blue spruce, Black Hills spruce, green ash, ponderosa pine.	Plains cottonwood	---
52B Parshall	Peking cotoneaster, Tatarian honeysuckle, American plum.	Black Hills spruce, Siberian crabapple, green ash, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood	---
53B*:					
Lehr	---	Green ash, ponderosa pine, Russian-olive, Siberian peashrub, eastern redcedar, Rocky Mountain juniper.	Siberian elm	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
53B*:					
Bowdle	---	Ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Siberian elm, green ash.	---	---
54*:					
Belfield	Silver buffaloberry, Siberian peashrub.	Russian-olive, green ash, Siberian elm.	---	---	---
Daglum	Silver buffaloberry, Siberian peashrub, Russian-olive, green ash.	Siberian elm	---	---	---
55B Moreau	Siberian peashrub, silver buffaloberry.	Siberian elm, green ash, Russian-olive.	---	---	---
56 Parshall	Silver buffaloberry, Siberian peashrub.	Russian-olive, green ash, Siberian elm.	---	---	---
57*:					
Daglum	Silver buffaloberry, Siberian peashrub, Russian-olive, green ash.	Siberian elm	---	---	---
Rhoades.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
2 Heil	Severe: ponding, percs slowly.	Severe: ponding, excess sodium.	Severe: ponding, percs slowly.	Severe: ponding.
3 Dimmick	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.
4 Grail	Slight	Slight	Moderate: slope.	Slight.
5C Wayden	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Moderate: too clayey.
6B*:				
Vebar	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
Parshall	Slight	Slight	Moderate: slope.	Slight.
7C*:				
Vebar	Slight	Slight	Severe: slope.	Slight.
Flasher	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Slight.
7D*:				
Vebar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Flasher	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Slight.
8*, 8B*:				
Belfield	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Daglum	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
9, 9B Regent	Slight	Slight	Moderate: slope.	Slight.
9C*:				
Regent	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
9C*:				
Cabba	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
10B*:				
Beisigl	Slight	Slight	Moderate: slope, small stones, thin layer.	Slight.
Lihen	Slight	Slight	Moderate: slope.	Slight.
11, 11B Moreau	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
12B*:				
Daglum	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Rhoades	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
13 Lawther	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
14B Parshall	Slight	Slight	Moderate: slope.	Slight.
15 Arnegard	Slight	Slight	Moderate: slope.	Slight.
16, 16B Shambo	Slight	Slight	Moderate: slope.	Slight.
17, 17B Chama	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
17C*:				
Chama	Slight	Slight	Severe: slope.	Slight.
Cabba	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
18, 18B Amor	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
18C*:				
Amor	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
18C*:				
Cabba	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
18D*:				
Amor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cabba	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
19F*:				
Cabba	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Chama	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
20F*:				
Flasher	Severe: slope, large stones, thin layer.	Severe: slope, large stones, thin layer.	Severe: large stones, slope, thin layer.	Severe: slope.
Beisigl	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope.
Parshall	Slight	Slight	Severe: slope.	Slight.
21B Ruso	Slight	Slight	Moderate: slope.	Slight.
22 Bowdle	Slight	Slight	Slight	Slight.
22B Bowdle	Slight	Slight	Moderate: slope.	Slight.
24 Straw	Severe: flooding.	Slight	Slight	Slight.
25B Lihen	Slight	Slight	Moderate: slope.	Slight.
26 Regan	Severe: flooding, wetness, excess salt.	Severe: wetness, excess salt.	Severe: wetness, excess salt.	Severe: wetness.
27E*:				
Sinnigam	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: erodes easily.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
27E*:				
Daglum	Severe: large stones, excess sodium.	Severe: large stones, excess sodium.	Severe: large stones, slope, excess sodium.	Moderate: large stones.
28 Harriet	Severe: flooding, wetness, percs slowly.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness.
29 Korchea	Severe: flooding.	Slight	Moderate: flooding.	Slight.
30 Straw	Severe: flooding.	Moderate: flooding.	Slight	Moderate: flooding.
33, 33B Savage	Slight	Slight	Moderate: slope.	Severe: erodes easily.
34F*:				
Brandenburg	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.
Cabba	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Savage	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
35F*:				
Cabba	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope.	Severe: slope.
Amor	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Moderate: slope.
Savage	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
36 Velva	Severe: flooding.	Slight	Moderate: flooding.	Slight.
38*:				
Belfield	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Grail	Slight	Slight	Slight	Slight.
39*:				
Belfield	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.
Grail	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
40*. Dumps				
41B Ekalaka	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
42B Felor	Slight	Slight	Moderate: slope.	Slight.
43 Lefor	Slight	Slight	Slight	Slight.
43B Lefor	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
44, 44B Reeder	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
45B Felor	Slight	Slight	Moderate: slope.	Slight.
46 Parshall	Slight	Slight	Moderate: slope.	Slight.
47*, 47B*:				
Regent	Slight	Slight	Moderate: slope.	Slight.
Daglum	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
48F*:				
Lehr	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Shambo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cabba	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
49B*:				
Watrous	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
Felor	Slight	Slight	Moderate: slope.	Slight.
50B Yegen	Slight	Slight	Moderate: slope.	Slight.
52B Parshall	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
53B*:				
Lehr	Slight	Slight	Moderate: slope.	Slight.
Bowdle	Slight	Slight	Moderate: slope.	Slight.
54*:				
Belfield	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.
Daglum	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.
55B Moreau	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: too clayey.
56 Parshall	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Slight.
57*:				
Daglum	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.
Rhoades	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
2------------------Heil	Poor	Poor	Fair	Very poor	Good	Good	Poor	Good	Poor.
3------------------Dimmick	Very poor	Poor	Poor	Poor	Good	Good	Very poor	Fair	Poor.
4------------------Grail	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
5C-----------------Wayden	Poor	Fair	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor.
6B*:									
Vebar---------------	Fair	Good	Good	Very poor	Poor	Very poor	Good	Very poor	Good.
Parshall------------	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
7C*:									
Vebar---------------	Fair	Good	Good	Very poor	Poor	Very poor	Good	Very poor	Good.
Flasher-------------	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
7D*:									
Vebar---------------	Poor	Fair	Good	Very poor	Very poor	Very poor	Fair	Very poor	Good.
Flasher-------------	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
8*, 8B*:									
Belfield------------	Fair	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Fair.
Daglum--------------	Fair	Good	Fair	Very poor	Poor	Poor	Fair	Poor	Poor.
9, 9B--------------Regent	Fair	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
9C*:									
Regent--------------	Fair	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Cabba---------------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
10B*:									
Beisigl-------------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Lihen---------------	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
11, 11B------------Moreau	Fair	Good	Poor	Poor	Poor	Very poor	Fair	Very poor	Poor.
12B*:									
Daglum--------------	Fair	Good	Fair	Very poor	Poor	Poor	Fair	Poor	Poor.
Rhoades-------------	Poor	Poor	Poor	Very poor	Poor	Poor	Poor	Poor	Very poor.
13-----------------Lawther	Good	Good	Poor	Poor	Poor	Poor	Fair	Poor	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
14B Parshall	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
15 Arnegard	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
16, 16B Shambo	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
17, 17B Chama	Good	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
17C*:									
Chama	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Cabba	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
18, 18B Amor	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
18C*:									
Amor	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
Cabba	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
18D*:									
Amor	Poor	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Cabba	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
19F*:									
Cabba	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Chama	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
20F*:									
Flasher	Very poor	Very poor	Very poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Beisigl	Very poor	Very poor	Very poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Parshall	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
21B Ruso	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
22, 22B Bowdle	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
24 Straw	Good	Good	Good	Good	Good	Good	Good	Good	Good.
25B Lihen	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
26 Regan	Fair	Fair	Fair	Very poor	Good	Good	Fair	Good	Poor.
27E*:									
Sinnigam	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
27E*:									
Daglum	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
28 Harriet	Poor	Poor	Fair	Very poor	Good	Good	Poor	Good	Poor.
29 Korchea	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
30 Straw	Very poor	Very poor	Good	Good	Good	Good	Poor	Good	Good.
33, 33B Savage	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
34F*:									
Brandenburg	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Cabba	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Savage	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
35F*:									
Cabba	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Amor	Poor	Very poor	Good	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Savage	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
36 Velva	Fair	Good	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
38*:									
Belfield	Fair	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Fair.
Grail	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
39*:									
Belfield	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair	Very poor	Very poor.
Grail	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair	Very poor	Very poor.
40*. Dumps									
41B Ekalaka	Fair	Good	Poor	Fair	Poor	Very poor	Fair	Very poor	Poor.
42B Felor	Good	Good	Good	---	Very poor	Very poor	Good	Very poor	Good.
43, 43B Lefor	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
44, 44B Reeder	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
45B Felor	Good	Good	Good	---	Very poor	Very poor	Good	Very poor	Good.
46 Parshall	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
47*, 47B*:									
Regent	Fair	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Daglum	Fair	Good	Fair	Very poor	Poor	Poor	Fair	Poor	Poor.
48F*:									
Lehr	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Shambo	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Cabba	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
49B*:									
Watrous	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Felor	Good	Good	Good	---	Very poor	Very poor	Good	Very poor	Good.
50B Yegen	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
52B Parshall	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
53B*:									
Lehr	Fair	Good	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
Bowdle	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
54*:									
Belfield	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair	Very poor	Very poor.
Daglum	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor	Very poor	Very poor.
55B Moreau	Fair	Good	Poor	Poor	Poor	Very poor	Fair	Very poor	Poor.
56 Parshall	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair	Very poor	Very poor.
57*:									
Daglum	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor	Very poor	Very poor.
Rhoades	Poor	Poor	Poor	Very poor	Poor	Poor	Poor	Poor	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
2 Heil	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
3 Dimmick	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
4 Grail	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
5C Wayden	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
6B*:					
Vebar	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Parshall	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
7C*:					
Vebar	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Flasher	Slight	Slight	Slight	Moderate: slope.	Slight.
7D*:					
Vebar	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Flasher	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
8*, 8B*:					
Belfield	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Daglum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
9, 9B Regent	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
9C*:					
Regent	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
9C*:					
Cabba	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
10B*:					
Beisigl	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Lihen	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
11, 11B Moreau	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
12B*:					
Daglum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Rhoades	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
13 Lawther	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
14B Parshall	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
15 Arnegard	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
16 Shambo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
16B Shambo	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
17 Chama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
17B Chama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
17C*:					
Chama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Cabba	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
18 Amor	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
18B Amor	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
18C*:					
Amor	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Cabba	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
18D*:					
Amor	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Cabba	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope.
19F*:					
Cabba	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Chama	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
20F*:					
Flasher	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Beisigl	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Parshall	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
21B Ruso	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
22 Bowdle	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
22B Bowdle	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
24 Straw	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
25B----------------- Lihen	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
26------------------ Regan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
27E*:					
Sinnigam----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Daglum------------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
28------------------ Harriet	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, low strength.
29------------------ Korchea	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
30------------------ Straw	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
33, 33B------------ Savage	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
34F*:					
Brandenburg-------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Cabba-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Savage------------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
35F*:					
Cabba-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Amor--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Savage------------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
36------------------ Velva	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
38*:					
Belfield	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Grail	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
39*:					
Belfield	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Grail	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
40*. Dumps					
41B Ekalaka	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
42B Felor	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
43 Lefor	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
43B Lefor	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.
44 Reeder	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
44B Reeder	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
45B Felor	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
46 Parshall	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: frost action.
47*, 47B*:					
Regent	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Daglum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
48F*:					
Lehr	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
48F*:					
Shambo	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Cabba	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
49B*:					
Watrous	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.
Felor	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
50B Yegen	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.
52B Parshall	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
53B*:					
Lehr	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Bowdle	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
54*:					
Belfield	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Daglum	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
55B Moreau	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
56 Parshall	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.
57*:					
Daglum	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Rhoades	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2 Heil	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey, excess sodium.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
3 Dimmick	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
4 Grail	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
5C Wayden	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage, too clayey.	Severe: seepage.	Poor: area reclaim, too clayey, hard to pack.
6B*:					
Vebar	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Parshall	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
7C*:					
Vebar	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Flasher	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
7D*:					
Vebar	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, thin layer.
Flasher	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
8*, 8B*:					
Belfield	Severe: percs slowly.	Moderate: slope.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Daglum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, excess sodium.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
9, 9B Regent	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
9C*:					
Regent	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
Cabba	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: area reclaim.
10B*:					
Beisigl	Severe: thin layer, seepage, poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, too sandy.
Lihen	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
11, 11B Moreau	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
12B*:					
Daglum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, excess sodium.
Rhoades	Severe: percs slowly.	Moderate: seepage, slope.	Severe: seepage, too clayey.	Slight	Poor: too clayey, hard to pack.
13 Lawther	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
14B Parshall	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
15 Arnegard	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, too sandy.	Slight	Fair: too clayey, too sandy.
16, 16B Shambo	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
17, 17B Chama	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
17C*:					
Chama	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Cabba	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
18, 18B Amor	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
18C*:					
Amor	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Cabba	Severe: thin layer. seepage.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
18D*:					
Amor	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage, slope.	Poor: area reclaim, thin layer.
Cabba	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
19F*:					
Cabba	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, slope, thin layer.
Chama	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
20F*:					
Flasher	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, slope.
Beisigl	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too sandy, slope.
Parshall	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
21B Ruso	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
22, 22B: Bowdle	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
24: Straw	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Fair: too clayey.
25B: Lihen	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
26: Regan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
27E*:					
Sinnigam	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, too clayey, seepage.	Severe: seepage.	Poor: area reclaim, too clayey, small stones.
Daglum	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: seepage, slope.	Poor: area reclaim, thin layer.
28: Harriet	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, excess sodium.	Severe: flooding, wetness.	Poor: hard to pack, wetness, excess sodium.
29: Korchea	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
30: Straw	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding.	Fair: too clayey.
33, 33B: Savage	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
34F*:					
Brandenburg	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Cabba	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, thin layer, slope.
Savage	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
35F*:					
Cabba	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, small stones, slope.
Amor	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Savage	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
36 Velva	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
38*:					
Belfield	Severe: percs slowly.	Slight	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Grail	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
39*:					
Belfield	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.
Grail	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
40*. Dumps					
41B Ekalaka	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too sandy, excess sodium.	Severe: seepage.	Poor: too sandy, excess sodium.
42B Felor	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
43 Lefor	Moderate: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: area reclaim, thin layer.
43B Lefor	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
44, 44B Reeder	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
45B Felor	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
46 Parshall	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
47*, 47B*:					
Regent	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
Daglum	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, thin layer.
48F*:					
Lehr	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Shambo	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Cabba	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, thin layer, slope.
49B*:					
Watrous	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
Felor	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
50B Yegen	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
52B Parshall	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
53B*:					
Lehr	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
53B*:					
Bowdle	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
54*:					
Belfield	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.
Daglum	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, excess sodium.
55B Moreau	Severe: thin layer, wetness, percs slowly.	Severe: seepage.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: area reclaim, too clayey, hard to pack.
56 Parshall	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: too sandy, wetness.
57*:					
Daglum	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, excess sodium.
Rhoades	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2 Heil	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
3 Dimmick	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
4 Grail	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
5C Wayden	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
6B*:				
Vebar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, small stones.
Parshall	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
7C*, 7D*:				
Vebar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, small stones.
Flasher	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
8*, 8B*:				
Belfield	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Daglum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
9, 9B Regent	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
9C*:				
Regent	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Cabba	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
10B*:				
Beisigl	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, area reclaim, thin layer.
Lihen	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
11, 11B Moreau	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
12B*:				
Daglum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Rhoades	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
13 Lawther	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
14B Parshall	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
15 Arnegard	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
16, 16B Shambo	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
17, 17B Chama	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
17C*:				
Chama	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Cabba	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
18, 18B Amor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
18C*:				
Amor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Cabba	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
18D*:				
Amor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, slope.
Cabba	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
19F*:				
Cabba	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Chama	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
20F*:				
Flasher	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.
Beisigl	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Parshall	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
21B Ruso	Good	Probable	Probable	Poor: small stones, area reclaim.
22, 22B Bowdle	Good	Probable	Probable	Fair: area reclaim.
24 Straw	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
25B Lihen	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
26 Regan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
27E*:				
Sinnigam	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
27E*:				
Daglum	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, large stones.
28 Harriet	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
29 Korchea	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
30 Straw	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
33, 33B Savage	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
34F*:				
Brandenburg	Poor: large stones, slope.	Improbable: small stones, large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Cabba	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Savage	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
35F*:				
Cabba	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Amor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Savage	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
36 Velva	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
38*:				
Belfield	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Grail	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
39*:				
Belfield	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Grail	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
40*. Dumps				
41B Ekalaka	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
42B Felor	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
43 Lefor	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
43B Lefor	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
44, 44B Reeder	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
45B Felor	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
46 Parshall	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
47*, 47B*:				
Regent	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Daglum	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
48F*:				
Lehr	Good	Probable	Probable	Poor: small stones, area reclaim.
Shambo	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
48F*:				
Cabba	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
49B*:				
Watrous	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Felor	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
50B Yegen	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
52B Parshall	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
53B*:				
Lehr	Good	Probable	Probable	Poor: small stones, area reclaim.
Bowdle	Good	Probable	Probable	Fair: area reclaim.
54*:				
Belfield	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Daglum	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
55B Moreau	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
56 Parshall	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
57*:				
Daglum	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Rhoades	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
2 Heil	Slight	Severe: hard to pack, ponding, excess sodium.	Ponding, percs slowly, excess salt.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, excess sodium, percs slowly.
3 Dimmick	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
4 Grail	Slight	Moderate: piping, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
5C Wayden	Severe: seepage.	Severe: thin layer.	Deep to water	Slope, slow intake, percs slowly.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
6B*:						
Vebar	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing, thin layer.	Area reclaim, soil blowing.	Area reclaim.
Parshall	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
7C*:						
Vebar	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing, thin layer.	Area reclaim, soil blowing.	Area reclaim.
Flasher	Severe: seepage.	Severe: thin layer.	Deep to water	Slope, soil blowing, thin layer.	Area reclaim, soil blowing.	Area reclaim.
7D*:						
Vebar	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, thin layer.	Slope, area reclaim, soil blowing.	Slope, area reclaim.
Flasher	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, droughty, fast intake.	Slope, area reclaim, soil blowing.	Slope, droughty, area reclaim.
8*:						
Belfield	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Excess sodium, percs slowly.
Daglum	Slight	Severe: excess sodium.	Deep to water	Percs slowly	Percs slowly	Excess sodium, percs slowly.
8B*:						
Belfield	Moderate: slope.	Severe: excess sodium.	Deep to water	Percs slowly, slope, excess sodium.	Percs slowly	Excess sodium, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
8B*:						
Daglum	Moderate: slope.	Severe: excess sodium.	Deep to water	Percs slowly, slope.	Percs slowly	Excess sodium, percs slowly.
9 Regent	Moderate: seepage.	Severe: hard to pack.	Deep to water	Percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
9B Regent	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
9C*:						
Regent	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
Cabba	Severe: seepage.	Severe: piping.	Deep to water	Slope, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
10B*:						
Beisigl	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Area reclaim, too sandy.	Droughty, area reclaim.
Lihen	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
11 Moreau	Moderate: seepage.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
11B Moreau	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
12B*:						
Daglum	Moderate: slope.	Severe: excess sodium.	Deep to water	Percs slowly, slope.	Percs slowly	Excess sodium, percs slowly.
Rhoades	Moderate: depth to rock, slope.	Severe: excess sodium.	Deep to water	Percs slowly, slope.	Percs slowly	Excess sodium, percs slowly.
13 Lawther	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Excess salt, percs slowly.
14B Parshall	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
15 Arnegard	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
16 Shambo	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
16B Shambo	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
17----------------- Chama	Moderate: seepage.	Severe: piping.	Deep to water	Thin layer-----	Area reclaim, erodes easily.	Erodes easily, area reclaim.
17B---------------- Chama	Moderate: seepage, slope.	Severe: piping.	Deep to water	Thin layer, slope.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
17C*:						
Chama-------------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Thin layer, slope.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
Cabba-------------	Severe: seepage.	Severe: piping.	Deep to water	Slope, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
18----------------- Amor	Moderate: seepage.	Severe: piping.	Deep to water	Thin layer-----	Area reclaim---	Area reclaim.
18B---------------- Amor	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Area reclaim---	Area reclaim.
18C*:						
Amor--------------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Area reclaim---	Area reclaim.
Cabba-------------	Severe: seepage.	Severe: piping.	Deep to water	Slope, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
18D*:						
Amor--------------	Severe: slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, area reclaim.	Slope, area reclaim.
Cabba-------------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
19F*:						
Cabba-------------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Chama-------------	Severe: slope.	Severe: piping.	Deep to water	Thin layer, slope.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
20F*:						
Flasher-----------	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, area reclaim.	Large stones, slope.
Beisigl-----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, thin layer.	Slope, large stones, area reclaim.	Large stones, slope, droughty.
Parshall----------	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
21B: Ruso	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
22: Bowdle	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
22B: Bowdle	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
24: Straw	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
25B: Lihen	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
26: Regan	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action, excess salt.	Wetness, flooding, excess salt.	Wetness	Wetness, excess salt.
27E*:						
Sinnigam	Severe: seepage.	Severe: thin layer.	Deep to water	Large stones, droughty, thin layer.	Large stones, depth to rock, area reclaim.	Large stones, erodes easily.
Daglum	Severe: slope.	Severe: excess sodium.	Deep to water	Slope, percs slowly, excess sodium.	Slope, area reclaim, percs slowly.	Slope, excess sodium, area reclaim.
28: Harriet	Slight	Severe: piping, wetness, excess sodium.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, excess sodium, erodes easily.
29: Korchea	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
30: Straw	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
33: Savage	Slight	Severe: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
33B: Savage	Moderate: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
34F*:						
Brandenburg	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Cabba	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Savage	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
35F*:						
Cabba	Severe: seepage, slope.	Severe: piping.	Deep to water	Thin layer, slope, excess salt.	Slope, large stones, area reclaim.	Large stones, slope, area reclaim.
Amor	Severe: slope.	Severe: piping.	Deep to water	Thin layer, slope.	Slope, large stones, area reclaim.	Large stones, slope, area reclaim.
Savage	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
36 Velva	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
38*:						
Belfield	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Excess sodium, percs slowly.
Grail	Slight	Moderate: piping, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
39*:						
Belfield	Slight	Severe: excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Percs slowly	Excess salt, excess sodium, droughty.
Grail	Slight	Moderate: piping, hard to pack, wetness.	Deep to water	Droughty, percs slowly, excess salt.	Percs slowly	Excess salt, droughty, percs slowly.
40*. Dumps						
41B Ekalaka	Severe: seepage.	Severe: piping, excess sodium.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Excess sodium, droughty.
42B Felor	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
43 Lefor	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
43B Lefor	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope, soil blowing, thin layer.	Area reclaim, soil blowing.	Area reclaim.
44 Reeder	Moderate: seepage.	Severe: piping.	Deep to water	Thin layer	Area reclaim	Area reclaim.
44B Reeder	Moderate: seepage, slope.	Severe: piping.	Deep to water	Thin layer, slope.	Area reclaim	Area reclaim.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
45B: Felor	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
46: Parshall	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
47*:						
Regent	Moderate: seepage.	Severe: hard to pack.	Deep to water	Percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
Daglum	Moderate: seepage.	Severe: excess sodium.	Deep to water	Percs slowly	Area reclaim, percs slowly.	Excess sodium, area reclaim.
47B*:						
Regent	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
Daglum	Moderate: seepage, slope.	Severe: excess sodium.	Deep to water	Slope, percs slowly.	Area reclaim, percs slowly.	Excess sodium, area reclaim.
48F*:						
Lehr	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Shambo	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.
Cabba	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
49B*:						
Watrous	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Depth to rock, area reclaim.	Depth to rock, area reclaim.
Felor	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
50B: Yegen	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Favorable	Favorable.
52B: Parshall	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
53B*:						
Lehr	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
Bowdle	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
54*:						
Belfield	Slight	Severe: excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Percs slowly	Excess salt, excess sodium, droughty.
Daglum	Slight	Severe: excess sodium.	Deep to water	Droughty, percs slowly.	Percs slowly	Excess salt, excess sodium, droughty.
55B Moreau	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Area reclaim, percs slowly.	Excess salt, area reclaim, percs slowly.
56 Parshall	Severe: seepage.	Severe: piping.	Deep to water	Droughty, excess salt.	Too sandy	Excess salt, droughty.
57*:						
Daglum	Slight	Severe: excess sodium.	Deep to water	Droughty, percs slowly.	Percs slowly	Excess salt, excess sodium, droughty.
Rhoades	Moderate: depth to rock.	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Excess salt, excess sodium, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
2---------------- Heil	0-3	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-100	25-50	10-25
	3-17	Silty clay, clay	CH	A-7	0	100	100	90-100	75-100	50-75	25-45
	17-60	Silty clay, silty clay loam, loam.	CH, CL	A-7, A-6	0	100	100	85-100	60-100	25-75	11-45
3---------------- Dimmick	0-31	Silty clay, clay	CH, CL	A-7	0	100	100	90-100	75-95	40-70	15-40
	31-60	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	75-95	45-70	20-45
4---------------- Grail	0-12	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-50	10-30
	12-31	Silty clay, clay loam, clay.	CL, CH, ML	A-7, A-6	0	100	95-100	95-100	70-95	35-60	10-35
	31-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-95	30-55	10-35
5C--------------- Wayden	0-4	Silty clay-------	CH, CL	A-7	0	100	100	90-100	75-95	40-60	15-30
	4-16	Silty clay, clay	CH, CL	A-7	0	100	100	90-100	75-95	40-60	15-30
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
6B*:											
Vebar-----------	0-6	Fine sandy loam	SM, ML	A-4, A-2	0	95-100	90-100	60-100	30-55	---	NP
	6-32	Fine sandy loam, loam, sandy loam.	SM, ML	A-4, A-2	0	95-100	90-100	60-100	30-55	---	NP
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Parshall--------	0-10	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	10-60	Fine sandy loam, sandy loam, loam.	SM, ML	A-4, A-2	0	100	100	60-100	25-55	---	NP
7C*:											
Vebar-----------	0-6	Fine sandy loam	SM, ML	A-4, A-2	0	95-100	90-100	60-100	30-55	---	NP
	6-32	Fine sandy loam, loam, sandy loam.	SM, ML	A-4, A-2	0	95-100	90-100	60-100	30-55	---	NP
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Flasher---------	0-6	Fine sandy loam	SM	A-2, A-4	0-5	85-100	85-100	60-100	30-50	---	NP
	6-16	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0-5	85-100	85-100	50-100	15-35	---	NP
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
7D*:											
Vebar-----------	0-6	Fine sandy loam	SM, ML	A-4, A-2	0	95-100	90-100	60-100	30-55	---	NP
	6-32	Fine sandy loam, loam, sandy loam.	SM, ML	A-4, A-2	0	95-100	90-100	60-100	30-55	---	NP
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Flasher---------	0-4	Loamy fine sand	SM	A-2	0-5	85-100	85-100	50-100	15-35	---	NP
	4-15	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0-5	85-100	85-100	50-100	15-35	---	NP
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8*, 8B*:											
Belfield--------	0-6	Clay loam--------	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-30
	6-28	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	35-65	15-40
	28-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	30-55	10-30
Daglum----------	0-7	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	15-25
	7-19	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	19-60	Clay, silty clay, silty clay loam.	CL	A-7, A-6	0	100	100	90-100	65-95	35-50	20-30
9, 9B------------ Regent	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	7-32	Silty clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	80-100	40-70	15-45
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
9C*:											
Regent----------	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	7-32	Silty clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	80-100	40-70	15-45
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cabba-----------	0-4	Loam-------------	ML, CL-ML	A-4	0-5	90-100	85-100	70-90	60-80	20-30	NP-10
	4-13	Loam, silt loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	85-100	80-95	25-35	5-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
10B*:											
Beisigl---------	0-2	Loamy fine sand	SM, SM-SC	A-2, A-4	0	95-100	85-100	75-95	20-40	<20	NP-5
	2-24	Loamy fine sand, fine sand.	SM	A-2	0	95-100	85-100	50-100	15-35	---	NP
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Lihen-----------	0-15	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
	15-60	Loamy fine sand, loamy sand, fine sand.	SM	A-2	0	100	100	50-80	15-35	---	NP
11, 11B---------- Moreau	0-4	Silty clay-------	CH	A-7	0	100	100	90-100	75-100	50-75	25-50
	4-24	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	75-100	45-75	20-50
	24-35	Clay, channery silty clay, silty clay loam.	CH, CL	A-7	0-6	75-100	70-100	60-100	50-100	45-75	20-50
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
12B*:											
Daglum----------	0-9	Loam-------------	SM, ML, CL-ML, SM-SC	A-4	0	100	100	75-90	45-65	20-30	3-10
	9-30	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	30-60	Clay, silty clay, silty clay loam.	CL	A-7, A-6	0	100	100	90-100	65-95	35-50	20-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
12B*:											
Rhoades	0-2	Loam	SM, ML, SC, CL	A-4, A-6	0	100	100	75-90	45-65	20-35	NP-15
	2-13	Clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	90-100	80-95	40-75	20-45
	13-54	Silty clay, clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-100	75-95	35-70	20-40
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
13 Lawther	0-8	Silty clay	CL, CH	A-7	0	100	100	90-100	75-100	45-70	25-40
	8-42	Silty clay, clay	CL, CH	A-7, A-6	0	100	100	90-100	75-100	35-70	15-40
	42-60	Silty clay, clay	CL, CH	A-7, A-6	0	100	100	90-100	75-100	35-70	15-40
14B Parshall	0-10	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	10-60	Fine sandy loam, sandy loam, loam.	SM, ML	A-4, A-2	0	100	100	60-100	25-55	---	NP
15 Arnegard	0-6	Loam	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-90	20-35	5-20
	6-36	Loam, clay loam	CL	A-6	0	100	100	85-100	50-90	25-40	12-25
	36-60	Loam, clay loam, loamy fine sand.	SM, ML, CL, SC	A-4, A-6	0	100	100	70-100	40-80	15-40	NP-15
16, 16B Shambo	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	3-13
	6-45	Loam, silt loam, clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-40	3-18
	45-60	Stratified sandy loam to clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-40	3-18
17, 17B Chama	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-20
	6-31	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-100	30-50	5-25
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
17C*:											
Chama	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-20
	6-31	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-100	30-50	5-25
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cabba	0-4	Silt loam	ML, CL-ML	A-4	0-5	90-100	85-100	70-90	60-80	20-30	NP-10
	4-13	Loam, silt loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	85-100	80-95	25-35	5-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
18, 18B Amor	0-5	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	65-85	25-40	3-18
	5-30	Clay loam, loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	75-100	50-95	20-45	2-25
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
18C*, 18D*:											
Amor------------	0-5	Loam------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	65-85	25-40	3-18
	5-30	Clay loam, loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	75-100	50-95	20-45	2-25
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cabba-----------	0-4	Loam------------	ML, CL-ML	A-4	0-5	90-100	85-100	70-90	60-80	20-30	NP-10
	4-13	Loam, silt loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	85-100	80-95	25-35	5-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
19F*:											
Cabba-----------	0-4	Silt loam--------	ML, CL-ML	A-4	0-5	90-100	85-100	70-90	60-80	20-30	NP-10
	4-14	Loam, silt loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	85-100	80-95	25-35	5-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Chama-----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-20
	6-31	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-100	30-50	5-25
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
20F*:											
Flasher---------	0-4	Loamy fine sand	SM	A-2	3-25	85-100	85-100	50-100	15-35	---	NP
	4-15	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0-20	85-100	85-100	50-100	15-35	---	NP
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Beisigl---------	0-2	Loamy fine sand	SM, SM-SC	A-2, A-4	3-25	95-100	85-100	75-95	20-40	<20	NP-5
	2-24	Loamy fine sand, fine sand.	SM	A-2	0-20	95-100	85-100	50-100	15-35	---	NP
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Parshall--------	0-10	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	10-60	Fine sandy loam, sandy loam, loam.	SM, ML	A-4, A-2	0	100	100	60-100	25-55	---	NP
21B-------------- Ruso	0-6	Fine sandy loam	SM	A-2, A-4	0-1	95-100	95-100	60-70	30-40	---	NP
	6-30	Fine sandy loam, sandy loam.	SM	A-2	0	100	100	60-70	30-40	---	NP
	30-60	Sandy loam, gravelly loamy sand.	SM	A-2, A-4	0-1	85-100	85-100	60-70	30-40	---	NP
22, 22B---------- Bowdle	0-6	Loam------------	ML, CL	A-6, A-4	0	100	95-100	85-95	55-80	30-40	7-15
	6-28	Loam, clay loam	CL, ML	A-4, A-6	0	95-100	90-100	70-95	50-75	30-40	8-15
	28-60	Very gravelly sand, gravelly loamy sand, very gravelly loamy sand.	SM, SW-SM, SP-SM	A-1, A-2	0-5	60-95	50-85	25-50	5-30	<30	NP-5
24--------------- Straw	0-30	Loam------------	CL-ML	A-4	0	95-100	90-100	85-100	60-90	20-30	5-10
	30-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	60-85	25-40	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
25B-------------- Lihen	0-15	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
	15-60	Loamy fine sand, fine sand.	SM	A-2	0	100	100	50-80	15-35	---	NP
26--------------- Regan	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	20-40	5-20
	8-60	Stratified loamy fine sand to silty clay.	ML, CL, SC, SM	A-7, A-6, A-4	0	100	100	65-100	35-95	15-50	NP-30
27E*:											
Sinnigam--------	0-5	Loam-------------	CL-ML, CL	A-4, A-6	0-5	85-100	80-95	70-85	55-75	25-35	5-15
	5-17	Extremely stony clay loam, flaggy clay loam, very flaggy clay loam.	GC	A-6, A-7, A-2	25-50	35-70	30-65	25-60	20-50	35-50	15-25
	17-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Daglum----------	0-9	Extremely stony loam, clay loam.	ML, CL-ML, CL	A-4, A-6	5-40	100	100	90-100	60-85	20-35	5-20
	9-29	Clay, loam, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-70	15-45
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
28--------------- Harriet	0-4	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	5-20
	4-40	Clay loam, silty clay loam, clay.	CL, CH	A-7, A-6	0	100	95-100	90-100	70-100	35-70	20-40
	40-60	Stratified loam to clay.	CL, CL-ML, CH	A-4, A-6, A-7	0	100	95-100	90-100	60-100	20-65	5-40
29--------------- Korchea	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	75-95	50-70	15-30	5-15
	8-60	Stratified sandy loam to clay loam.	SM-SC, CL-ML, CL, SC	A-4, A-6, A-7	0	100	100	70-100	40-95	20-50	5-20
30--------------- Straw	0-30	Loam-------------	CL-ML	A-4	0	95-100	90-100	85-100	60-90	20-30	5-10
	30-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	60-85	25-40	5-20
33, 33B---------- Savage	0-7	Clay loam--------	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	15-30
	7-25	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	25-51	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	51-60	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
34F*:											
Brandenburg-----	0-4	Channery loam----	CL-ML, GM-GC, CL, SM-SC	A-2, A-4, A-6	0-5	60-100	40-80	35-75	30-65	20-35	5-15
	4-16	Very channery loam, channery loam, sandy loam.	SM, GM, CL	A-2, A-4, A-6	0-5	60-100	40-80	35-75	30-65	0-35	NP-15
	16-60	Fragmental material.	GP	A-1	80-85	15-25	5-10	0-5	0	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34F*:											
Cabba-----------	0-4	Loam-------------	ML, CL-ML	A-4	0-5	90-100	85-100	70-90	60-80	20-30	NP-10
	4-13	Loam, silt loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	85-100	80-95	25-35	5-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Savage----------	0-7	Clay loam--------	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	15-30
	7-25	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	25-51	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	51-60	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
35F*:											
Cabba-----------	0-4	Extremely stony loam.	ML, CL-ML, SM, SM-SC	A-4	40-45	95-100	90-100	65-85	45-65	15-30	NP-10
	4-13	Gravelly loam, silt loam.	CL, CL-ML, SM-SC, GM-GC	A-4, A-6	0-10	60-100	55-100	50-100	45-95	25-35	5-15
	13-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Amor------------	0-5	Extremely stony loam.	CL, CL-ML	A-4, A-6	3-25	100	95-100	90-100	65-85	20-40	5-20
	5-30	Clay loam, loam, fine sandy loam.	CL, CL-ML	A-4, A-6, A-7	0-20	100	95-100	75-100	50-95	20-45	5-30
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Savage----------	0-7	Clay loam--------	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	15-30
	7-25	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	25-51	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
	51-60	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-70	20-45
36--------------- Velva	0-5	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	100	60-95	35-65	15-25	NP-5
	5-60	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	100	100	70-95	40-75	20-30	NP-5
38*:											
Belfield--------	0-6	Clay loam--------	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-30
	6-28	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	35-65	15-40
	28-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	30-55	10-30
Grail-----------	0-12	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-50	10-30
	12-31	Silty clay, silty clay loam, clay.	CL, CH, ML	A-7, A-6	0	100	95-100	95-100	70-95	35-60	10-35
	31-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-95	30-55	10-35

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
39*:											
Belfield--------	0-6	Clay loam--------	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-30
	6-28	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	35-65	15-40
	28-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	30-55	10-30
Grail-----------	0-12	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-80	30-50	10-30
	12-31	Silty clay, silty clay loam, clay.	CL, CH, MH, ML	A-7, A-6	0	100	100	95-100	70-95	35-60	10-35
	31-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	85-100	60-95	30-55	10-35
40*. Dumps											
41B-------------- Ekalaka	0-7	Fine sandy loam	SM, ML	A-2, A-4	0	100	100	70-85	30-60	20-35	NP-10
	7-17	Fine sandy loam, sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	100	70-100	30-70	20-35	NP-10
	17-60	Fine sandy loam, loam, sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	100	50-100	30-40	20-40	NP-15
42B-------------- Felor	0-7	Loam-------------	ML, CL	A-4, A-6	0	100	90-100	85-95	60-75	30-40	5-15
	7-24	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-7	0	85	85-100	80-95	40-75	30-45	10-20
	24-60	Silty clay, silty clay loam, clay.	CH, ML, MH, CL	A-7	0	100	100	95-100	85-95	45-60	15-30
43--------------- Lefor	0-13	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-85	40-55	<25	NP-5
	13-32	Sandy clay loam, loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	80-100	35-55	20-40	5-25
	32-51	Fine sandy loam, loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	100	70-85	30-55	<25	NP-5
	51-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
43B-------------- Lefor	0-7	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-85	40-55	15-25	NP-5
	7-15	Sandy clay loam, loam.	SC, CL, CL-ML, SM-SC	A-6, A-4	0	100	100	80-100	35-55	20-40	5-25
	15-38	Fine sandy loam, sandy clay loam, loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	70-85	30-55	15-25	NP-5
	38-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
44, 44B---------- Reeder	0-6	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-85	20-40	5-20
	6-26	Clay loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	60-80	25-50	5-30
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
45B: Felor	0-4	Loam	ML, CL	A-4, A-6	0	100	90-100	85-95	60-75	30-40	5-15
	4-30	Clay loam, loam, sandy clay loam.	SC, CL	A-6, A-7	0	100	90-100	80-95	40-75	30-45	10-20
	30-60	Silty clay, silty clay loam, clay.	CH, ML, MH, CL	A-7	0	100	90-100	85-100	85-95	45-60	15-30
46: Parshall	0-14	Loam	ML	A-4	0	100	100	85-95	60-75	20-40	NP-10
	14-39	Sandy loam, fine sandy loam.	SM, ML	A-4, A-2	0	100	100	60-85	30-55	<20	NP
	39-60	Loam, fine sandy loam, sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	60-95	25-60	<25	NP-5
47*, 47B*:											
Regent	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	7-32	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	90-100	80-100	40-70	15-45
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Daglum	0-9	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	15-25
	9-29	Clay, loam, clay loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-75	15-45
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
48F*:											
Lehr	0-5	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-80	20-40	3-15
	5-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	85-95	60-75	25-40	5-15
	15-31	Gravelly coarse sandy loam, gravelly loamy sand.	SM, SP-SM	A-1	0-5	65-90	50-75	30-50	5-15	---	NP
	31-60	Very gravelly loamy sand, gravelly loamy sand.	SM, SP, GM, GP	A-1	0-5	40-70	25-50	10-35	2-15	---	NP
Shambo	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	3-13
	6-45	Loam, silt loam, clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-40	3-18
	45-60	Stratified loam to silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-40	3-18
Cabba	0-4	Loam	ML, CL-ML	A-4	0-5	90-100	85-100	70-90	60-80	20-30	NP-10
	4-13	Loam, silt loam	CL, CL-ML	A-6, A-4	0-5	95-100	90-100	85-100	80-95	25-35	5-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
49B*:											
Watrous	0-12	Loam	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-80	20-40	5-20
	12-24	Loam, clay loam, channery clay loam.	CL	A-6, A-7	0-10	90-100	85-100	80-100	55-80	25-45	10-30
	24-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Felor	0-11	Loam	ML, CL	A-4, A-6	0	100	100	85-95	60-75	30-40	5-15
	11-25	Loam, clay loam	SC, CL	A-6, A-7	0	100	100	80-95	40-75	30-45	10-20
	25-60	Silty clay, silty clay loam.	CH, ML, MH, CL	A-7	0	100	100	95-100	85-95	45-60	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
50B-------------- Yegen	0-7	Fine sandy loam	SM-SC, SM	A-4	0	100	100	75-85	40-50	20-30	NP-10
	7-19	Sandy clay loam, clay loam, loam.	SM-SC, SC, CL, CL-ML	A-6, A-4	0	100	100	80-100	45-60	25-40	5-15
	19-27	Sandy loam, loam	SC, SM-SC	A-6, A-4,	0	100	100	65-100	30-45	25-35	5-15
	27-60	Fine sandy loam, sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0	100	100	60-100	30-45	15-25	NP-10
52B-------------- Parshall	0-7	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	7-60	Fine sandy loam, loam, loamy sand.	SM, ML	A-4, A-2	0	100	100	60-100	25-55	---	NP
53B*:											
Lehr------------	0-5	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-80	20-40	3-15
	5-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	85-95	60-75	25-40	5-15
	15-31	Gravelly coarse sandy loam, gravelly loamy sand.	SM, SP-SM	A-1	0-5	65-90	50-75	30-50	5-15	---	NP
	31-60	Very gravelly loamy sand, gravelly loamy sand.	SM, SP, GM, GP	A-1	0-5	40-70	25-50	10-35	2-15	---	NP
Bowdle----------	0-6	Loam-------------	ML, CL	A-6, A-4	0	100	95-100	85-95	55-80	30-40	7-15
	6-28	Loam, clay loam	CL, ML	A-4, A-6	0	95-100	90-100	70-95	50-75	30-40	8-15
	28-60	Very gravelly sand, gravelly loamy sand, very gravelly loamy sand.	SM, SW-SM, SP-SM	A-1, A-2	0-5	60-95	50-85	25-50	5-30	<30	NP-5
54*:											
Belfield--------	0-6	Clay loam--------	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-30
	6-28	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	35-65	15-40
	28-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	100	100	90-100	70-100	30-55	10-30
Daglum----------	0-7	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	15-25
	7-19	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	19-60	Clay, silty clay, silty clay loam.	CL	A-7, A-6	0	100	100	90-100	65-95	35-50	20-30
55B-------------- Moreau	0-4	Silty clay-------	CH	A-7	0	100	100	90-100	75-100	50-75	25-50
	4-24	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	75-100	45-75	20-50
	24-35	Clay, channery silty clay, silty clay loam.	CH, CL	A-7	0-6	75-100	70-100	60-100	50-100	45-75	20-50
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
56--------------- Parshall	0-14	Loam-------------	ML	A-4	0	100	100	85-95	60-75	20-40	NP-10
	14-60	Fine sandy loam, loam, loamy sand.	SM, ML	A-4, A-2	0	100	100	60-100	25-55	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
57*:											
Daglum----------	0-9	Loam------------	SM, ML, CL-ML, SM-SC	A-4	0	100	100	75-90	45-65	20-30	3-10
	9-30	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	70-95	35-75	15-45
	30-60	Clay, silty clay, silty clay loam.	CL	A-7, A-6	0	100	100	90-100	65-95	35-50	20-30
Rhoades---------	0-2	Loam------------	SM, ML, SC, CL	A-4, A-6	0	100	100	75-90	45-65	20-35	NP-15
	2-13	Clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	90-100	80-95	40-75	20-45
	13-54	Silty clay, clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-100	75-95	35-70	20-40
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	mmhos/cm				
2----------------	0-3	<0.06	0.15-0.24	5.6-7.3	<2	Moderate	0.28	3	7
Heil	3-17	<0.06	0.13-0.18	6.1-9.0	4-16	High------	0.28		
	17-60	<0.06	0.13-0.18	7.4-9.0	4-16	High------	0.28		
3----------------	0-31	<0.2	0.14-0.23	6.1-7.8	<2	High------	0.28	5	4
Dimmick	31-60	<0.06	0.13-0.20	6.6-8.4	<2	High------	0.28		
4----------------	0-12	0.2-0.6	0.18-0.20	6.1-8.4	<2	Moderate	0.32	5	7
Grail	12-31	0.06-0.2	0.14-0.17	6.6-8.4	<2	High------	0.32		
	31-60	0.06-0.2	0.13-0.22	7.4-8.4	<4	Moderate	0.32		
5C---------------	0-4	0.06-0.2	0.15-0.18	7.4-9.0	<2	High------	0.32	2	4
Wayden	4-16	0.06-0.2	0.14-0.19	7.4-9.0	<8	High------	0.32		
	16-60	---	---	---	---	----------	----		
6B*:									
Vebar-----------	0-6	2.0-6.0	0.15-0.17	6.1-7.8	<2	Low-------	0.20	4	3
	6-32	2.0-6.0	0.15-0.17	6.1-8.4	<2	Low-------	0.20		
	32-60	---	---	---	---	----------	----		
Parshall--------	0-10	2.0-6.0	0.16-0.18	5.6-8.4	<2	Low-------	0.20	5	3
	10-60	2.0-6.0	0.12-0.17	5.6-8.4	<2	Low-------	0.20		
7C*:									
Vebar-----------	0-6	2.0-6.0	0.15-0.17	6.1-7.8	<2	Low-------	0.20	4	3
	6-32	2.0-6.0	0.15-0.17	6.1-8.4	<2	Low-------	0.20		
	32-60	---	---	---	---	----------	----		
Flasher---------	0-6	6.0-20	0.13-0.17	6.6-8.4	<2	Low-------	0.24	2	3
	6-16	6.0-20	0.08-0.12	6.6-8.4	<2	Low-------	0.17		
	16-60	---	---	---	---	----------	----		
7D*:									
Vebar-----------	0-6	2.0-6.0	0.15-0.17	6.1-7.8	<2	Low-------	0.20	4	3
	6-32	2.0-6.0	0.15-0.17	6.1-8.4	<2	Low-------	0.20		
	32-60	---	---	---	---	----------	----		
Flasher---------	0-4	6.0-20	0.08-0.12	6.6-8.4	<2	Low-------	0.17	2	2
	4-15	6.0-20	0.08-0.12	6.6-8.4	<2	Low-------	0.17		
	15-60	---	---	---	---	----------	----		
8*, 8B*:									
Belfield--------	0-6	0.2-2.0	0.17-0.22	6.1-7.3	<2	High------	0.32	3	7
	6-28	0.06-0.2	0.14-0.18	6.6-7.8	<2	High------	0.32		
	28-60	0.06-0.2	0.13-0.16	7.9-9.0	4-16	High------	0.32		
Daglum----------	0-7	0.6-2.0	0.16-0.18	5.6-7.3	<2	Moderate	0.32	3	6
	7-19	<0.2	0.12-0.14	6.1-9.0	2-8	High------	0.32		
	19-60	<0.2	0.12-0.14	7.9-9.0	8-16	High------	0.32		
9, 9B------------	0-7	0.06-0.2	0.17-0.20	6.1-7.8	<2	High------	0.32	4	7
Regent	7-32	0.06-0.2	0.17-0.20	7.4-9.0	<8	High------	0.32		
	32-60	---	---	---	---	----------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm				
9C*:									
Regent	0-7	0.06-0.2	0.17-0.20	6.1-7.8	<2	High	0.32	4	7
	7-32	0.06-0.2	0.17-0.20	7.4-9.0	<8	High	0.32		
	32-60	---	---	---	---	----------	----		
Cabba	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<4	Low	0.37	2	4L
	4-13	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.28		
	13-60	---	---	---	---	----------	----		
10B*:									
Beisigl	0-2	6.0-20	0.11-0.13	6.6-8.4	<2	Low	0.17	4	2
	2-24	6.0-20	0.05-0.10	7.4-8.4	<2	Low	0.17		
	24-60	---	---	---	---	----------	----		
Lihen	0-15	6.0-20	0.10-0.12	6.1-7.8	<2	Low	0.17	5	2
	15-60	6.0-20	0.06-0.10	7.4-8.4	<2	Low	0.17		
11, 11B Moreau	0-4	0.06-0.2	0.15-0.18	7.4-9.0	<2	High	0.32	4	4
	4-24	0.06-0.2	0.14-0.17	7.4-9.0	<4	High	0.32		
	24-35	0.06-0.2	0.13-0.15	7.4-9.0	2-16	High	0.32		
	35-60	---	---	---	---	----------	----		
12B*:									
Daglum	0-9	0.6-6.0	0.13-0.15	5.6-7.3	<2	Low	0.32	3	6
	9-30	<0.2	0.12-0.14	6.1-9.0	2-8	High	0.32		
	30-60	<0.2	0.12-0.14	7.9-9.0	8-16	High	0.32		
Rhoades	0-2	0.6-6.0	0.13-0.15	5.6-7.3	<2	Low	0.32	3	6
	2-13	<0.2	0.10-0.12	>6.5	2-16	High	0.32		
	13-54	<0.2	0.10-0.12	>7.3	8-16	High	0.32		
	54-60	---	---	---	---	----------	----		
13 Lawther	0-8	0.06-0.2	0.14-0.17	6.6-8.4	<2	High	0.32	5	4
	8-42	0.06-0.2	0.14-0.17	7.4-9.0	<4	High	0.32		
	42-60	0.06-0.2	0.14-0.17	7.9-9.0	4-12	High	0.32		
14B Parshall	0-10	2.0-6.0	0.16-0.18	5.6-8.4	<2	Low	0.20	5	3
	10-60	2.0-6.0	0.12-0.17	5.6-8.4	<2	Low	0.20		
15 Arnegard	0-6	0.6-2.0	0.20-0.24	6.1-7.3	<2	Moderate	0.28	5	6
	6-36	0.6-2.0	0.16-0.22	6.1-7.8	<2	Moderate	0.28		
	36-60	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low	0.28		
16, 16B Shambo	0-6	0.6-2.0	0.20-0.22	6.1-7.3	<2	Low	0.28	5	6
	6-45	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.28		
	45-60	0.6-2.0	0.17-0.19	7.4-9.0	<2	Moderate	0.28		
17, 17B Chama	0-6	0.6-2.0	0.20-0.24	6.6-8.4	<2	Moderate	0.32	4	4L
	6-31	0.6-2.0	0.18-0.20	7.4-9.0	<2	Moderate	0.43		
	31-60	---	---	---	---	----------	----		
17C*:									
Chama	0-6	0.6-2.0	0.20-0.24	6.6-8.4	<2	Moderate	0.32	4	4L
	6-31	0.6-2.0	0.18-0.20	7.4-9.0	<2	Moderate	0.43		
	31-60	---	---	---	---	----------	----		
Cabba	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<4	Low	0.37	2	4L
	4-13	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.28		
	13-60	---	---	---	---	----------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm				
18, 18B---------- Amor	0-5	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	5-30	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	30-60	---	---	---	---	----------	----		
18C*, 18D*:									
Amor------------	0-5	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	5-30	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	30-60	---	---	---	---	----------	----		
Cabba-----------	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<4	Low-------	0.37	2	4L
	4-13	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.28		
	13-60	---	---	---	---	----------	----		
19F*:									
Cabba-----------	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<4	Low-------	0.37	2	4L
	4-14	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.28		
	14-60	---	---	---	---	----------	----		
Chama-----------	0-6	0.6-2.0	0.20-0.24	6.6-8.4	<2	Moderate	0.32	4	4L
	6-31	0.6-2.0	0.18-0.20	7.4-9.0	<2	Moderate	0.43		
	31-60	---	---	---	---	----------	----		
20F*:									
Flasher---------	0-4	6.0-20	0.08-0.12	6.6-8.4	<2	Low-------	0.17	2	8
	4-15	6.0-20	0.08-0.12	6.6-8.4	<2	Low-------	0.17		
	15-60	---	---	---	---	----------	----		
Beisigl---------	0-2	6.0-20	0.11-0.13	6.6-8.4	<2	Low-------	0.17	4	8
	2-24	6.0-20	0.05-0.10	7.4-8.4	<2	Low-------	0.17		
	24-60	---	---	---	---	----------	----		
Parshall--------	0-10	2.0-6.0	0.16-0.18	5.6-8.4	<2	Low-------	0.20	5	3
	10-60	2.0-6.0	0.12-0.17	5.6-8.4	<2	Low-------	0.20		
21B-------------- Ruso	0-6	2.0-6.0	0.13-0.15	6.6-7.3	<2	Low-------	0.20	4	3
	6-30	2.0-6.0	0.11-0.15	6.6-7.3	---	Low-------	0.20		
	30-60	>20	0.11-0.15	6.6-7.8	<2	Low-------	0.20		
22, 22B---------- Bowdle	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	4	6
	6-28	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28		
	28-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
24--------------- Straw	0-30	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low-------	0.32	5	5
	30-60	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.32		
25B-------------- Lihen	0-15	6.0-20	0.10-0.12	6.1-7.8	<2	Low-------	0.17	5	2
	15-60	6.0-20	0.06-0.10	7.4-8.4	<2	Low-------	0.17		
26--------------- Regan	0-8	0.2-2.0	0.11-0.15	7.4-8.4	8-16	Moderate	0.32	5	4L
	8-60	0.2-2.0	0.10-0.11	7.4-9.0	8-16	Moderate	0.32		
27E*:									
Sinnigam--------	0-5	0.6-2.0	0.15-0.19	6.1-7.8	<2	Moderate	0.37	1	6
	5-17	0.2-0.6	0.07-0.08	6.1-7.8	<2	Moderate	0.05		
	17-60	---	---	---	---	----------	----		
Daglum----------	0-9	0.6-2.0	0.20-0.24	6.1-7.3	<2	Moderate	0.32	3	8
	9-29	<0.2	0.12-0.14	6.1-9.0	2-8	High------	0.32		
	29-60	---	---	---	---	----------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm				
28---------------- Harriet	0-4	0.06-0.2	0.20-0.24	6.6-8.4	<2	Moderate	0.37	3	6
	4-40	<0.06	0.10-0.15	>7.3	4-16	High------	0.37		
	40-60	0.06-0.2	0.10-0.15	>7.8	4-16	Moderate	0.37		
29---------------- Korchea	0-8	0.6-2.0	0.17-0.21	6.6-8.4	<2	Low-------	0.28	5	5
	8-60	0.6-2.0	0.16-0.18	7.4-9.0	<2	Moderate	0.28		
30---------------- Straw	0-30	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low-------	0.32	5	5
	30-60	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.32		
33, 33B---------- Savage	0-7	0.6-2.0	0.18-0.23	6.1-7.8	<2	Moderate	0.37	5	7
	7-25	0.06-0.2	0.12-0.20	6.6-7.8	<2	High------	0.37		
	25-51	0.06-0.2	0.12-0.20	7.4-8.4	2-4	High------	0.37		
	51-60	0.06-0.6	0.12-0.20	7.4-8.4	4-8	High------	0.37		
34F*:									
Brandenburg-----	0-4	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-------	0.24	2	8
	4-16	0.6-2.0	0.13-0.20	6.6-7.8	---	Low-------	0.24		
	16-60	>20	0.01-0.03	6.6-8.4	<2	Low-------	0.10		
Cabba-----------	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<4	Low-------	0.37	2	4L
	4-13	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.28		
	13-60	---	---	---	---	-----------	----		
Savage----------	0-7	0.6-2.0	0.18-0.23	6.1-7.8	<2	Moderate	0.37	5	7
	7-25	0.06-0.6	0.12-0.20	6.6-7.8	<2	High------	0.37		
	25-51	0.06-0.6	0.12-0.20	7.4-8.4	2-4	High------	0.37		
	51-60	0.06-0.6	0.12-0.20	7.4-8.4	4-8	High------	0.37		
35F*:									
Cabba-----------	0-4	0.6-2.0	0.12-0.16	6.6-8.4	<4	Low-------	0.17	2	8
	4-13	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.32		
	13-60	---	---	---	---	-----------	----		
Amor------------	0-5	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.20	4	8
	5-30	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	30-60	---	---	---	---	-----------	----		
Savage----------	0-7	0.6-2.0	0.18-0.23	6.1-7.8	<2	Moderate	0.37	5	7
	7-25	0.06-0.6	0.12-0.20	6.6-7.8	<2	High------	0.37		
	25-51	0.06-0.6	0.12-0.20	7.4-8.4	2-4	High------	0.37		
	51-60	0.06-0.6	0.12-0.20	7.4-8.4	4-8	High------	0.37		
36---------------- Velva	0-5	2.0-6.0	0.13-0.22	6.6-7.8	<2	Low-------	0.20	5	3
	5-60	2.0-6.0	0.16-0.22	6.6-8.4	<2	Low-------	0.20		
38*:									
Belfield--------	0-6	0.2-2.0	0.17-0.22	6.1-7.3	<2	High------	0.32	3	7
	6-28	0.06-0.2	0.14-0.18	6.6-7.8	<2	High------	0.32		
	28-60	0.06-0.2	0.13-0.16	7.9-9.0	4-16	High------	0.32		
Grail-----------	0-12	0.2-0.6	0.18-0.20	6.1-8.4	<2	Moderate	0.32	5	7
	12-31	0.06-0.2	0.14-0.17	6.6-8.4	<2	High------	0.32		
	31-60	0.06-0.2	0.13-0.22	7.4-8.4	<4	Moderate	0.32		
39*:									
Belfield--------	0-6	0.2-2.0	0.09-0.11	6.1-7.3	8-16	High------	0.32	3	7
	6-28	0.06-0.2	0.07-0.09	6.6-7.8	8-16	High------	0.32		
	28-60	0.06-0.2	0.06-0.08	7.9-9.0	8-16	High------	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm				
39*:									
Grail----------	0-12	0.2-0.6	0.09-0.10	6.1-8.4	8-16	Moderate	0.32	5	7
	12-31	0.06-0.2	0.07-0.09	6.6-8.4	8-16	High------	0.32		
	31-60	0.06-0.2	0.06-0.11	7.4-8.4	8-16	Moderate	0.32		
40*. Dumps									
41B------------- Ekalaka	0-7	2.0-6.0	0.13-0.20	5.1-8.4	<2	Low-------	0.24	3	3
	7-17	0.06-0.2	0.11-0.13	7.4-9.0	2-8	Low-------	0.24		
	17-60	0.06-6.0	0.06-0.08	7.4-9.0	4-16	Low-------	0.24		
42B------------- Felor	0-7	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.28	4	6
	7-24	0.6-2.0	0.16-0.18	6.1-7.8	<2	Moderate	0.28		
	24-60	0.06-0.2	0.11-0.17	7.4-8.4	<2	High------	0.28		
43-------------- Lefor	0-13	2.0-6.0	0.16-0.18	5.1-7.3	<2	Low-------	0.20	4	3
	13-32	0.6-2.0	0.15-0.17	6.6-7.8	<2	Moderate	0.28		
	32-51	0.6-2.0	0.15-0.17	7.4-8.4	<2	Low-------	0.28		
	51-60	---	---	---	---	----------	----		
43B------------- Lefor	0-7	2.0-6.0	0.16-0.18	5.1-7.3	<2	Low-------	0.20	4	3
	7-15	0.6-2.0	0.15-0.17	6.6-7.8	<2	Moderate	0.28		
	15-38	0.6-2.0	0.15-0.17	7.4-8.4	<2	Low-------	0.28		
	38-60	---	---	---	---	----------	----		
44, 44B--------- Reeder	0-6	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.28	4	6
	6-26	0.6-2.0	0.15-0.18	6.6-8.4	<2	Moderate	0.28		
	26-60	---	---	---	---	----------	----		
45B------------- Felor	0-4	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.28	4	6
	4-30	0.6-2.0	0.16-0.18	6.1-7.8	<2	Moderate	0.28		
	30-60	0.06-0.2	0.11-0.17	7.4-8.4	<2	High------	0.28		
46-------------- Parshall	0-14	0.6-2.0	0.20-0.22	5.6-8.4	<2	Low-------	0.28	5	5
	14-39	2.0-6.0	0.12-0.17	5.6-8.4	<2	Low-------	0.20		
	39-60	2.0-6.0	0.11-0.19	5.6-8.4	<2	Low-------	0.20		
47*, 47B*:									
Regent----------	0-7	0.06-0.2	0.17-0.20	6.1-7.8	<2	High------	0.32	4	7
	7-32	0.06-0.2	0.17-0.20	7.4-9.0	<8	High------	0.32		
	32-60	---	---	---	---	----------	----		
Daglum----------	0-9	0.6-2.0	0.16-0.18	5.6-7.3	<2	Moderate	0.32	3	6
	9-29	<0.2	0.12-0.14	6.1-9.0	2-8	High------	0.32		
	29-60	---	---	---	---	----------	----		
48F*:									
Lehr------------	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low-------	0.28	3	5
	5-15	2.0-6.0	0.17-0.20	6.6-8.4	<2	Moderate	0.28		
	15-31	6.0-20	0.09-0.11	7.4-8.4	<2	Low-------	0.10		
	31-60	>6.0	0.02-0.04	7.4-8.4	<2	Low-------	0.10		
Shambo----------	0-6	0.6-2.0	0.20-0.22	6.1-7.3	<2	Low-------	0.28	5	6
	6-45	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.28		
	45-60	0.6-2.0	0.17-0.19	7.4-9.0	<2	Moderate	0.28		
Cabba-----------	0-4	0.6-2.0	0.16-0.20	6.6-8.4	<4	Low-------	0.37	2	4L
	4-13	0.6-2.0	0.14-0.18	7.4-9.0	2-8	Moderate	0.28		
	13-60	---	---	---	---	----------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm				
49B*:									
Watrous---------	0-12	0.6-2.0	0.20-0.24	6.1-7.8	<2	Moderate	0.28	4	6
	12-24	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.28		
	24-60	---	---	---	---	----------	----		
Felor-----------	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.28	4	6
	11-25	0.6-2.0	0.16-0.18	6.1-7.8	<2	Moderate	0.28		
	25-60	0.06-0.2	0.11-0.17	7.4-8.4	<2	High------	0.28		
50B------------- Yegen	0-7	2.0-6.0	0.12-0.16	6.6-7.3	<2	Low-------	0.24	5	3
	7-19	0.6-2.0	0.14-0.18	6.6-7.3	<2	Moderate	0.32		
	19-27	0.6-2.0	0.13-0.16	7.4-8.4	<2	Moderate	0.32		
	27-60	2.0-6.0	0.12-0.16	7.4-8.4	<4	Low-------	0.28		
52B------------- Parshall	0-7	2.0-6.0	0.16-0.18	5.6-8.4	<2	Low-------	0.20	5	3
	7-60	2.0-6.0	0.12-0.17	5.6-8.4	<2	Low-------	0.20		
53B*:									
Lehr------------	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low-------	0.28	3	5
	5-15	2.0-6.0	0.17-0.20	6.6-8.4	<2	Moderate	0.28		
	15-31	6.0-20	0.09-0.11	7.4-8.4	<2	Low-------	0.10		
	31-60	>6.0	0.02-0.04	7.4-8.4	<2	Low-------	0.10		
Bowdle----------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28	4	6
	6-28	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.28		
	28-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
54*:									
Belfield--------	0-6	0.2-2.0	0.09-0.11	6.1-7.3	8-16	High------	0.32	3	7
	6-28	0.06-0.2	0.07-0.09	6.6-7.8	8-16	High------	0.32		
	28-60	0.06-0.2	0.06-0.08	7.9-9.0	8-16	High------	0.32		
Daglum----------	0-7	0.6-2.0	0.08-0.09	5.6-7.3	8-16	Moderate	0.32	3	6
	7-19	<0.2	0.06-0.07	6.1-9.0	8-16	High------	0.32		
	19-60	<0.2	0.06-0.07	7.9-9.0	8-16	High------	0.32		
55B------------- Moreau	0-4	0.06-0.2	0.15-0.18	7.4-9.0	8-16	High------	0.32	4	4
	4-24	0.06-0.2	0.14-0.17	7.4-9.0	8-16	High------	0.32		
	24-35	0.06-0.2	0.13-0.15	7.4-9.0	8-16	High------	0.32		
	35-60	---	---	---	---	----------	----		
56-------------- Parshall	0-14	0.6-2.0	0.10-0.11	6.6-8.4	8-16	Low-------	0.28	5	5
	14-60	2.0-6.0	0.06-0.09	6.6-8.4	8-16	Low-------	0.20		
57*:									
Daglum----------	0-9	0.6-6.0	0.07-0.08	5.6-7.3	8-16	Low-------	0.32	3	6
	9-30	<0.2	0.06-0.07	6.1-9.0	8-16	High------	0.32		
	30-60	<0.2	0.06-0.07	7.9-9.0	8-16	High------	0.32		
Rhoades---------	0-2	0.6-6.0	0.13-0.15	5.6-7.3	8-16	Low-------	0.32	3	6
	2-13	<0.2	0.10-0.12	>6.5	8-16	High------	0.32		
	13-54	<0.2	0.10-0.12	>7.3	8-16	High------	0.32		
	54-60	---	---	---	---	----------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
2----------------- Heil	D	None---------	---	---	+1-1.0	Apparent	Mar-Sep	>60	---	Moderate	High-----	Moderate.
3----------------- Dimmick	D	None---------	---	---	+1-2.0	Apparent	Apr-Jul	>60	---	Moderate	High-----	Low.
4----------------- Grail	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
5C---------------- Wayden	D	None---------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
6B*:												
Vebar------------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate	Low.
Parshall---------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
7C*, 7D*:												
Vebar------------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate	Low.
Flasher----------	D	None---------	---	---	>6.0	---	---	7-20	Soft	Low------	Moderate	Low.
8*, 8B*:												
Belfield---------	C	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Daglum-----------	D	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
9*, 9B*----------- Regent	C	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
9C*:												
Regent-----------	C	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Cabba------------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Moderate	High-----	Low.
10B*:												
Beisigl----------	A	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate	Low.
Lihen------------	A	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
11, 11B----------- Moreau	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
12B*:												
Daglum	D	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Rhoades	D	None	---	---	>6.0	---	---	>40	Soft	Low	High	Moderate.
13 Lawther	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
14B Parshall	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
15 Arnegard	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
16, 16B Shambo	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
17, 17B Chama	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
17C*:												
Chama	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Cabba	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
18, 18B Amor	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Moderate.
18C*, 18D*:												
Amor	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Moderate.
18C*, 18D*:												
Cabba	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
19F*:												
Cabba	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
Chama	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
20F*:												
Flasher	D	None	---	---	>6.0	---	---	7-20	Soft	Low	Moderate	Low.
Beisigl	A	None	---	---	>6.0	---	---	20-40	Soft	Low	Moderate	Low.
Parshall	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
21B Ruso	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
22, 22B----------- Bowdle	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
24---------------- Straw	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
25B--------------- Lihen	A	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
26---------------- Regan	B/D	Occasional	Brief to long.	Mar-Jun	0-1.0	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.
27E*:												
Sinnigam---------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
Daglum-----------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Moderate.
28---------------- Harriet	D	Occasional	Long------	Apr-Jun	0-1.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Moderate.
29---------------- Korchea	B	Occasional	Very brief to brief.	Mar-Jun	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
30---------------- Straw	B	Frequent----	Brief-----	Mar-May	>6.0	---	---	>60	---	Moderate	High-----	Low.
33, 33B----------- Savage	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
34F*:												
Brandenburg------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Cabba------------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	High-----	Low.
Savage-----------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
35F*:												
Cabba------------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	High-----	Low.
Amor-------------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Moderate.
Savage-----------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
36---------------- Velva	B	Occasional	Very brief to brief.	Mar-Jun	>6.0	---	---	>60	---	Moderate	High-----	Low.
38*:												
Belfield---------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
38*:												
Grail------------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
39*:												
Belfield---------	C	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>60	---	Low------	High-----	Moderate.
Grail------------	C	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>60	---	Moderate	High-----	Moderate.
40*. Dumps												
41B--------------- Ekalaka	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
42B--------------- Felor	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
43---------------- Lefor	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
43B--------------- Lefor	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
44, 44B----------- Reeder	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Moderate.
45B--------------- Felor	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
46---------------- Parshall	B	None--------	---	---	3.0-5.0	Apparent	Apr-Jul	>60	---	Moderate	Moderate	Low.
47*, 47B*:												
Regent-----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Daglum-----------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Moderate.
48F*:												
Lehr-------------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
Shambo-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Cabba------------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	High-----	Low.
49B*:												
Watrous----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
Felor------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
50B--------------- Yegen	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
52B--------------- Parshall	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
53B*:												
Lehr-------------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
Bowdle-----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
54*:												
Belfield---------	C	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>60	---	Low------	High-----	Moderate.
Daglum-----------	D	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>60	---	Moderate	High-----	Moderate.
55B--------------- Moreau	D	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	20-40	Soft	Low------	High-----	Moderate.
56---------------- Parshall	B	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>60	---	Moderate	High-----	Moderate.
57*:												
Daglum-----------	D	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>60	---	Moderate	High-----	Moderate.
Rhoades----------	D	None--------	---	---	3.0-6.0	Apparent	Oct-Jun	>40	Soft	Low------	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX TEST DATA

(Dashes indicate data were not available. LL means liquid limit; PI, plasticity index; MD, maximum dry density; OM, optimum moisture)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								LL	PI	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			MD	OM
											Pct		Lb/ft3	Pct
Belfield silt loam: (S83ND-041-86)														
Bt1----- 17 to 25	A-6(10)	CL	100	100	100	99	93	---	48	---	36	15	115	14
C------- 40 to 60	A-6(11)	CL	100	100	100	100	99	---	47	---	38	18	120	12
Daglum loam: (S83ND-041-86)														
Bt------ 5 to 19	A-7-6(17)	CL	100	100	100	100	93	---	53	---	49	27	111	15
Cyz----- 27 to 60	A-6(13)	CL	100	100	100	100	83	---	39	---	39	22	---	---
Dimmick silty clay: (S83ND-041-91)														
A3------ 13 to 23	A-7-6(20)	CH	100	100	100	99	91	---	60	---	62	38	---	---
C1------ 38 to 48	A-7-6(20)	CH	100	100	100	99	93	---	68	---	67	43	---	---
Felar loam: (S83ND-041-87)														
Bt1----- 8 to 17	A-6(10)	CL	100	100	100	97	73	---	39	---	36	17	117	14
2C------ 41 to 60	A-7-6(16)	CL	100	100	100	97	92	---	54	---	45	28	122	12
Grail silty clay loam: (S84ND-041-192)														
Bt2----- 23 to 31	A-7-6(19)	CH	100	100	100	100	95	---	50	---	54	31	111	15
Bk------ 48 to 60	A-7-6(19)	CH	100	100	100	99	92	---	51	---	53	32	112	15
Harriet silty clay loam: (S83ND-041-86)														
Bt22---- 9 to 26	A-7-6(19)	CH	100	100	100	99	91	---	53	---	57	33	108	17
Cy------ 40 to 60	A-7-6(16)	CL	100	100	100	95	75	---	42	---	45	27	120	13
Heil silty clay loam: (S83ND-041-93)														
Btz----- 12 to 17	A-7-6(20)	CH	100	100	100	100	96	---	74	---	67	40	---	---
Bw------ 42 to 52	A-7-6(20)	CH	100	100	100	99	95	---	72	---	71	43	---	---

TABLE 17.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								LL	PI	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			MD	OM
											Pct		Lb/ft^3	Pct
Moreau silty clay: (S83ND-041-95)														
Bw2----- 9 to 15	A-7-6(19)	CH	100	100	100	100	97	---	61	---	53	30	110	16
Byz----- 24 to 35	A-7-6(20)	CH	100	100	100	100	99	---	75	---	63	41	113	15
Parshall fine sandy loam: (S84ND-041-165)														
Bw2----- 17 to 28	A-2-4(0)	SM	100	100	100	99	31	---	8	---	---	NP	115	14
Bk1----- 34 to 46	A-2-4(0)	SM	100	100	100	99	28	---	8	---	---	NP	122	12
Regent clay loam: (S83ND-041-94)														
Bt------ 7 to 13	A-7-6(15)	CL	100	100	100	100	96	---	53	---	49	23	107	17
Bk2----- 22 to 32	A-7-6(19)	CH	100	100	100	100	100	---	78	---	56	31	112	15
Savage clay loam: (S83ND-041-90)														
Bt------ 9 to 14	A-7-6(16)	CL	100	100	100	100	87	---	42	---	48	26	109	16
Cyz1---- 51 to 59	A-7-6(16)	CL	100	100	100	100	90	---	46	---	47	28	---	---
Watrous loam: (S83ND-041-84)														
Bt------ 12 to 20	A-7-6(10)	CL	100	100	100	98	62	---	31	---	41	22	117	14
Btk----- 20 to 24	A-7-6(11)	CL	100	99	95	91	58	---	31	---	44	24	118	13
Yegen loam: (S84ND-041-164)														
Bt2----- 14 to 25	A-6(6)	CL	100	100	100	99	59	---	25	---	29	13	124	11
Bk2----- 39 to 53	A-4(1)	SM-SC	100	100	100	99	42	---	25	---	24	7	124	11

TABLE 18.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Amor	Fine-loamy, mixed Typic Haploborolls
Arnegard	Fine-loamy, mixed Pachic Haploborolls
Beisigl	Mixed, frigid Typic Ustipsamments
Belfield	Fine, montmorillonitic Glossic Natriborolls
Bowdle	Fine-loamy over sandy or sandy-skeletal, mixed Pachic Haploborolls
Brandenburg	Fragmental, mixed, frigid Typic Ustorthents
Cabba	Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents
Chama	Fine-silty, mixed Entic Haploborolls
*Daglum	Fine, montmorillonitic Typic Natriborolls
Dimmick	Fine, montmorillonitic, frigid Typic Haplaquolls
Ekalaka	Coarse-loamy, mixed Typic Natriborolls
Felor	Fine-loamy, mixed Typic Argiborolls
Flasher	Mixed, frigid, shallow Typic Ustipsamments
Grail	Fine, montmorillonitic Pachic Argiborolls
Harriet	Fine, montmorillonitic, frigid Typic Natraquolls
Heil	Fine, montmorillonitic, frigid Typic Natraquolls
Korchea	Fine-loamy, mixed (calcareous), frigid Mollic Ustifluvents
Lawther	Fine, montmorillonitic Vertic Haploborolls
*Lefor	Fine-loamy, mixed Typic Argiborolls
Lehr	Fine-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls
Lihen	Sandy, mixed Entic Haploborolls
*Moreau	Fine, montmorillonitic Typic Haploborolls
Parshall	Coarse-loamy, mixed Pachic Haploborolls
Reeder	Fine-loamy, mixed Typic Argiborolls
*Regan	Fine-silty, frigid Typic Calciaquolls
Regent	Fine, montmorillonitic Typic Argiborolls
Rhoades	Fine, montmorillonitic Leptic Natriborolls
Ruso	Coarse-loamy, mixed Pachic Haploborolls
Savage	Fine, montmorillonitic Typic Argiborolls
Shambo	Fine-loamy, mixed Typic Haploborolls
Sinnigam	Clayey-skeletal, mixed Lithic Argiborolls
Straw	Fine-loamy, mixed Cumulic Haploborolls
Vebar	Coarse-loamy, mixed Typic Haploborolls
*Velva	Coarse-loamy, mixed Fluventic Haploborolls
Watrous	Fine-loamy, mixed Typic Argiborolls
Wayden	Clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthents
Yegen	Fine-loamy, mixed Typic Argiborolls

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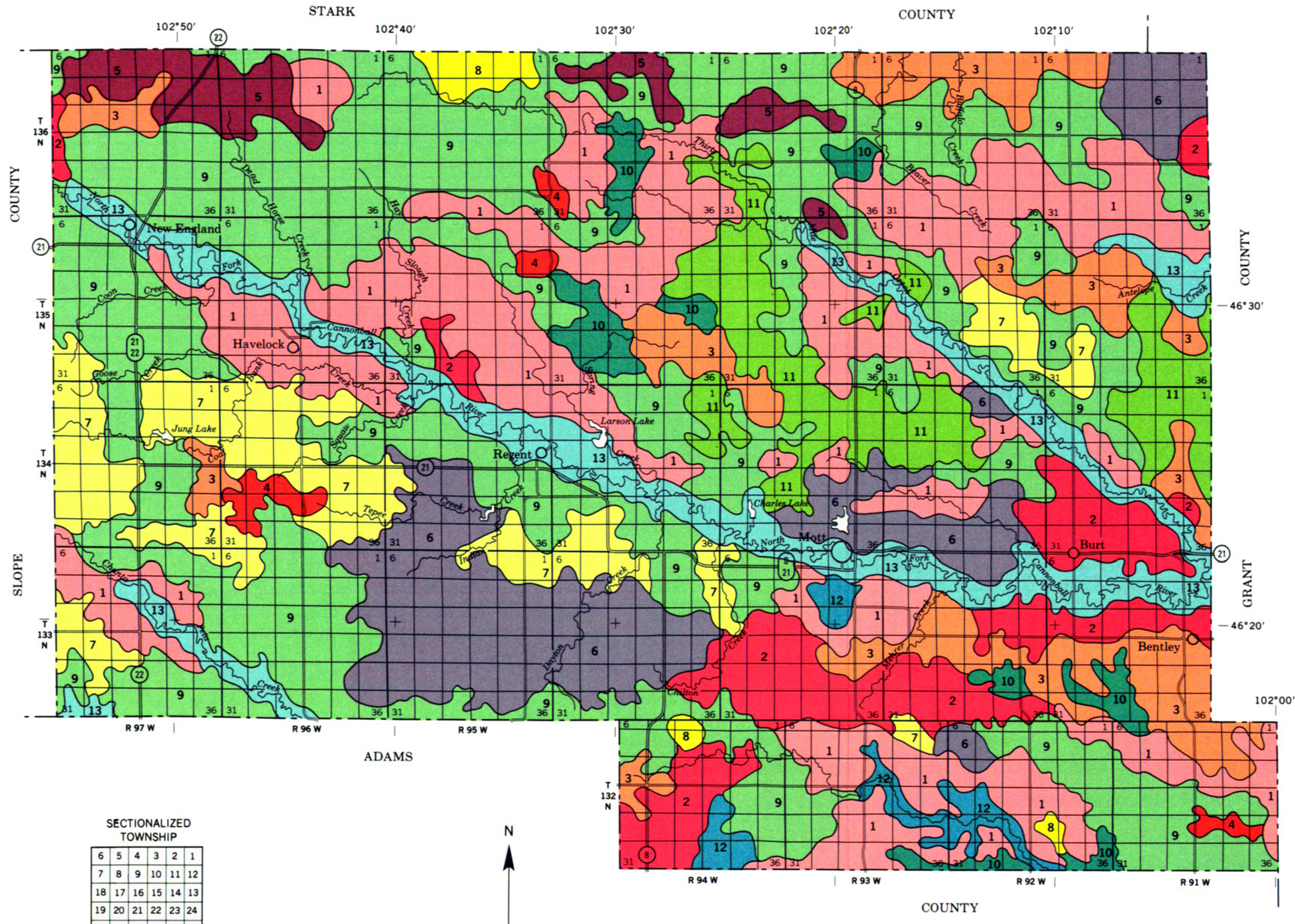


LEGEND*

DEEP TO SHALLOW, LOAMY AND SANDY SOILS ON UPLANDS

1 Parshall-Vebar-Shambo association: Deep and moderately deep, nearly level to moderately sloping, well drained, loamy soils

2 Vebar-Parshall-Flasher association: Deep to shallow, nearly level to very steep, well drained and somewhat excessively drained, loamy and sandy soils

DEEP TO SHALLOW, LOAMY AND SILTY SOILS ON UPLANDS

3 Amor-Belfield-Cabba association: Deep to shallow, level to very steep, well drained and moderately well drained, loamy soils

4 Cabba-Savage-Amor association: Shallow to deep, nearly level to very steep, well drained, loamy soils

5 Felor-Amor-Cabba association: Deep to shallow, nearly level to very steep, well drained, loamy soils

6 Chama-Belfield-Cabba association: Deep to shallow, level to very steep, well drained and moderately well drained, silty and loamy soils

MODERATELY DEEP AND DEEP, CLAYEY AND LOAMY SOILS ON UPLANDS

7 Moreau-Lawther-Amor association: Moderately deep and deep, nearly level to moderately sloping, well drained and moderately well drained, clayey and loamy soils

8 Dimmick-Belfield-Reeder association: Deep and moderately deep, level to gently sloping, very poorly drained, well drained, and moderately well drained, clayey and loamy soils

DEEP AND MODERATELY DEEP, LOAMY AND SILTY SOILS ON UPLANDS

9 Belfield-Amor-Regent association: Deep and moderately deep, level to strongly sloping, well drained and moderately well drained, loamy and silty soils

10 Daglum-Belfield-Amor association: Deep and moderately deep, level to moderately sloping, well drained and moderately well drained, loamy soils

11 Regent-Belfield-Daglum association: Moderately deep and deep, level to moderately sloping, well drained and moderately well drained, silty and loamy soils

DEEP, LOAMY SOILS ON FLOOD PLAINS AND TERRACES

12 Harriet-Daglum-Belfield association: Deep, level to gently sloping, poorly drained, well drained, and moderately well drained, loamy soils

13 Korchea-Bowdle-Parshall association: Deep, level to gently sloping, well drained, loamy soils

*The texture terms in the descriptive headings refer to the surface layer of the major soils in each of the associations.

Compiled 1988

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION
NORTH DAKOTA COOPERATIVE EXTENSION SERVICE
NORTH DAKOTA STATE SOIL CONSERVATION COMMITTEE

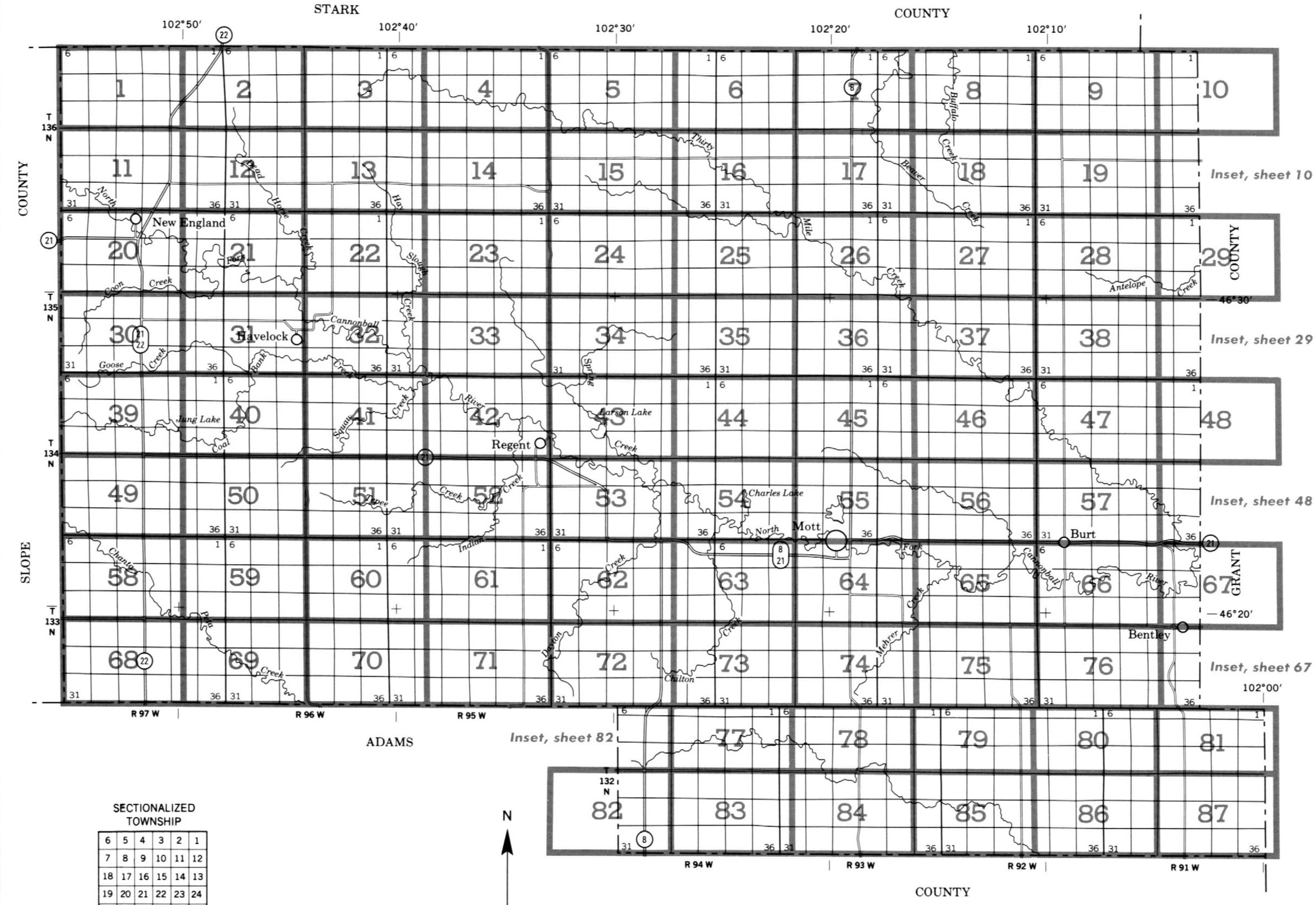
GENERAL SOIL MAP
HETTINGER COUNTY, NORTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Original text from each individual map sheet read:
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1975 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS
HETTINGER COUNTY, NORTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
2	Heil silty clay loam
3	Dimmick silty clay
4	Grail clay loam, 1 to 3 percent slopes
5C	Wayden silty clay, 2 to 9 percent slopes
6B	Vebar-Parshall fine sandy loams, 1 to 6 percent slopes
7C	Vebar-Flasher fine sandy loams, 3 to 9 percent slopes
7D	Vebar-Flasher complex, 9 to 20 percent slopes
8	Belfield-Daglum clay loams, 1 to 3 percent slopes
8B	Belfield-Daglum clay loams, 3 to 6 percent slopes
9	Regent silty clay loam, 1 to 3 percent slopes
9B	Regent silty clay loam, 3 to 6 percent slopes
9C	Regent-Cabba complex, 6 to 9 percent slopes
10B	Beisigl-Lihen loamy fine sands, 1 to 6 percent slopes
11	Moreau silty clay, 1 to 3 percent slopes
11B	Moreau silty clay, 3 to 6 percent slopes
12B	Daglum-Rhoades loams, 1 to 6 percent slopes
13	Lawther silty clay, 1 to 3 percent slopes
14B	Parshall fine sandy loam, 1 to 6 percent slopes
15	Arnegard loam, 1 to 3 percent slopes
16	Shambo loam, 1 to 3 percent slopes
16B	Shambo loam, 3 to 6 percent slopes
17	Chama silt loam, 1 to 3 percent slopes
17B	Chama silt loam, 3 to 6 percent slopes
17C	Chama-Cabba silt loams, 6 to 9 percent slopes
18	Amor loam, 1 to 3 percent slopes
18B	Amor loam, 3 to 6 percent slopes
18C	Amor-Cabba loams, 6 to 9 percent slopes
18D	Amor-Cabba loams, 9 to 15 percent slopes
19F	Cabba-Chama silt loams, 15 to 70 percent slopes
20F	Flasher-Beisigl-Parshall complex, 6 to 70 percent slopes, extremely stony
21B	Ruso fine sandy loam, 1 to 6 percent slopes
22	Bowdle loam, 0 to 3 percent slopes
22B	Bowdle loam, 3 to 6 percent slopes
24	Straw loam, 0 to 3 percent slopes
25B	Lihen loamy fine sand, 1 to 6 percent slopes
26	Regan loam, 0 to 3 percent slopes
27E	Sinnigam-Daglum complex, 1 to 25 percent slopes
28	Harriet loam
29	Korchea loam, 0 to 3 percent slopes
30	Straw loam, channeled
33	Savage clay loam, 1 to 3 percent slopes
33B	Savage clay loam, 3 to 6 percent slopes
34F	Brandenburg-Cabba-Savage complex, 6 to 70 percent slopes
35F	Cabba-Amor-Savage complex, 9 to 70 percent slopes, extremely stony
36	Velva fine sandy loam, 0 to 3 percent slopes
38	Belfield-Grail clay loams, 0 to 3 percent slopes
39	Belfield-Grail clay loams, saline, 0 to 3 percent slopes
40	Dumps-Pits complex
41B	Ekalaka fine sandy loam, 1 to 6 percent slopes
42B	Felor loam, terrace, 1 to 6 percent slopes
43	Lefor fine sandy loam, 0 to 3 percent slopes
43B	Lefor fine sandy loam, 3 to 6 percent slopes
44	Reeder loam, 1 to 3 percent slopes
44B	Reeder loam, 3 to 6 percent slopes
45B	Felor loam, 1 to 6 percent slopes
46	Parshall loam, moderately wet, 1 to 3 percent slopes
47	Regent-Daglum complex, 1 to 3 percent slopes
47B	Regent-Daglum complex, 3 to 6 percent slopes
48F	Lehr-Shambo-Cabba loams, 6 to 50 percent slopes
49B	Watrous-Felor loams, 1 to 6 percent slopes
50B	Yegen fine sandy loam, 1 to 6 percent slopes
52B	Parshall fine sandy loam, terrace, 1 to 6 percent slopes
53B	Lehr-Bowdle loams, 1 to 6 percent slopes
54	Belfield-Daglum clay loams, saline, 1 to 3 percent slopes
55B	Moreau silty clay, saline, 1 to 6 percent slopes
56	Parshall loam, saline, 1 to 3 percent slopes
57	Daglum-Rhoades loams, saline, 1 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

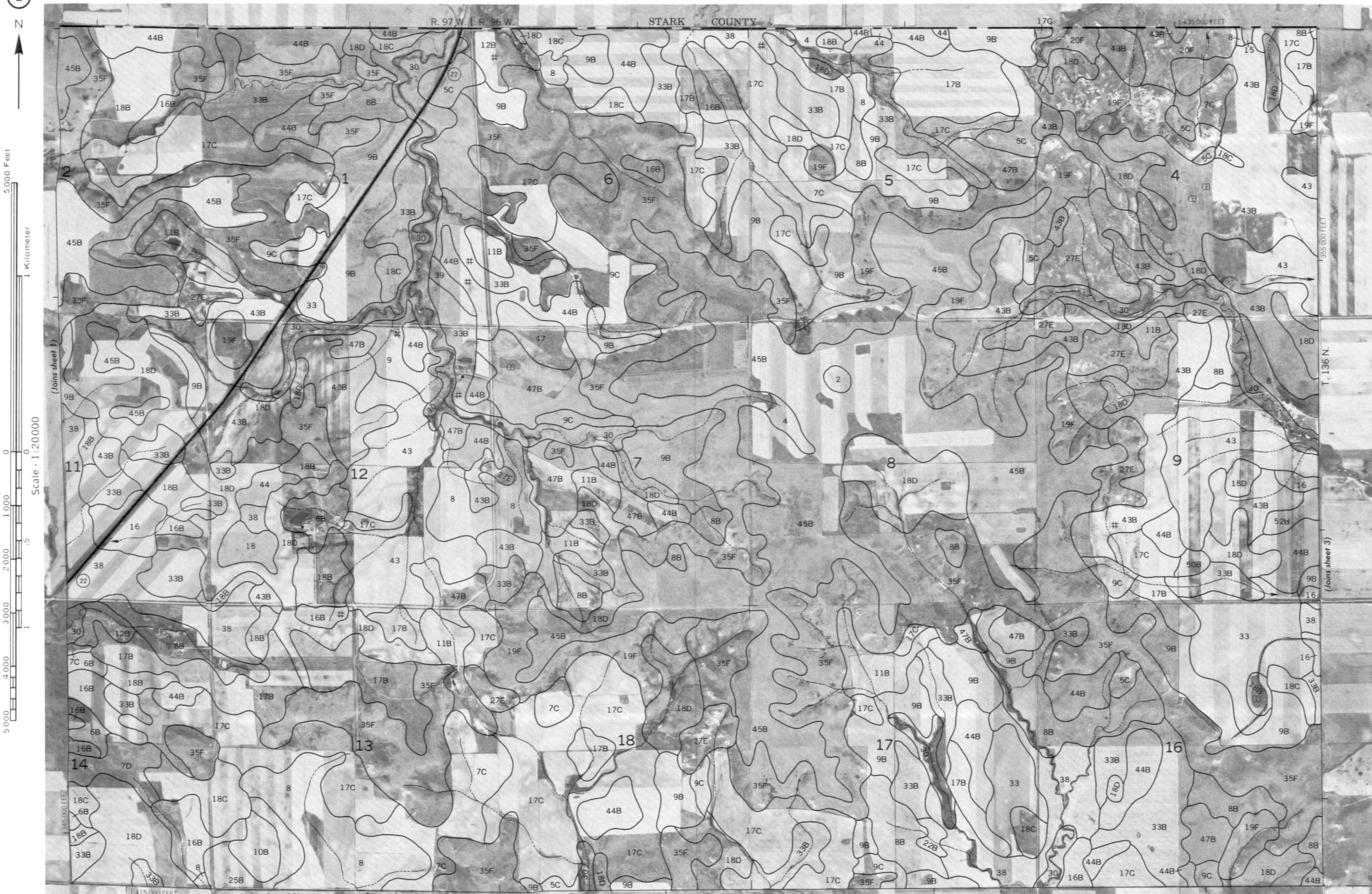
DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Porcelanite outcrop
- Mine sinks (up to 10 acres)
- Saline seep (up to 3 acres)

HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 1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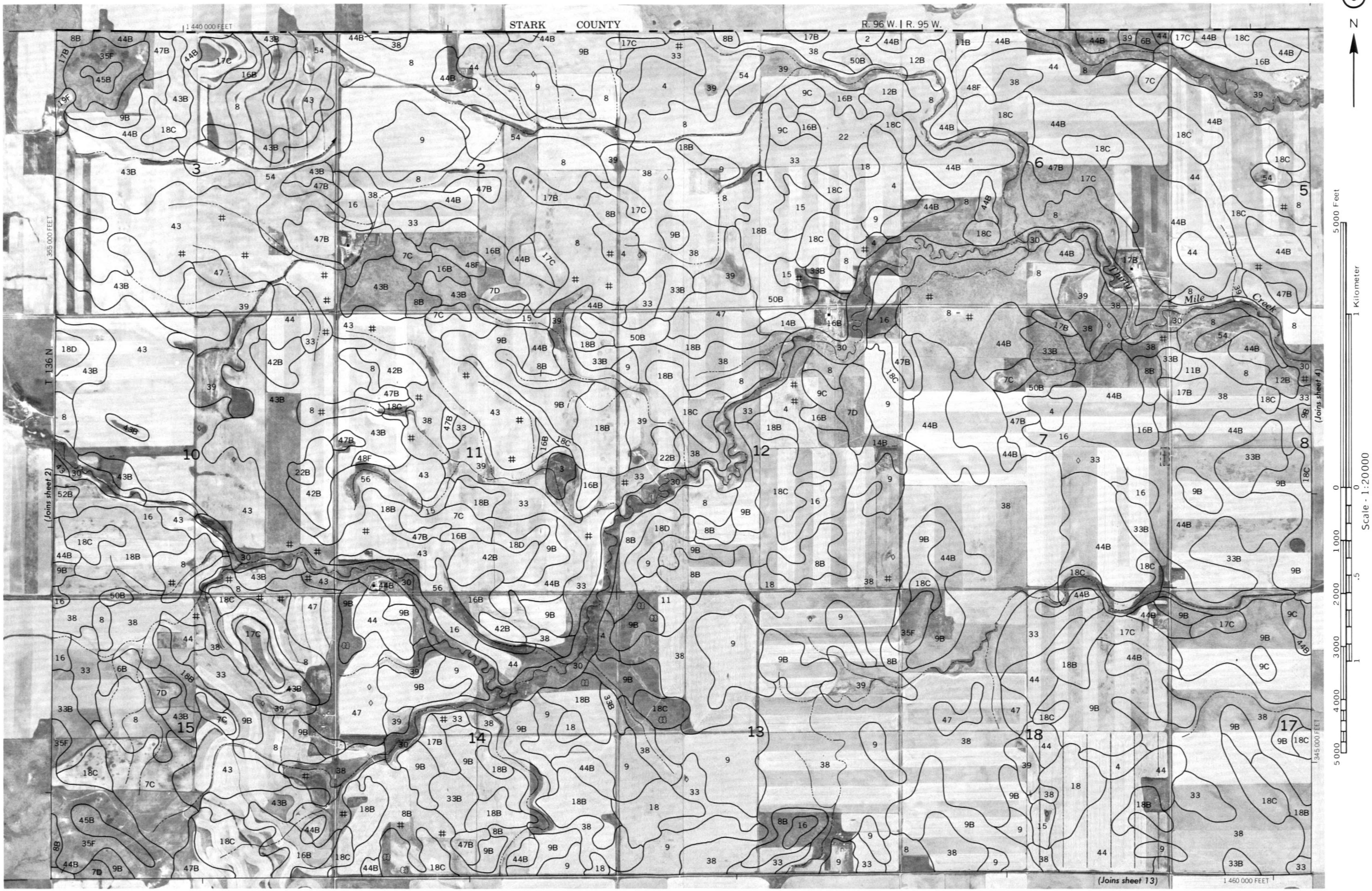
R. 97 W.
R. 96 W.
STARK COUNTY
1 435 000 FEET
355 000 FEET
T. 136 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 12)
1 415 000 FEET
335 000 FEET
5000 Feet
1 Kilometer
Scale - 1:20000


STARK COUNTY
R. 96 W. | R. 95 W.
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365 000 FEET
T. 136 N.
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 13)
Thirty Mile Creek
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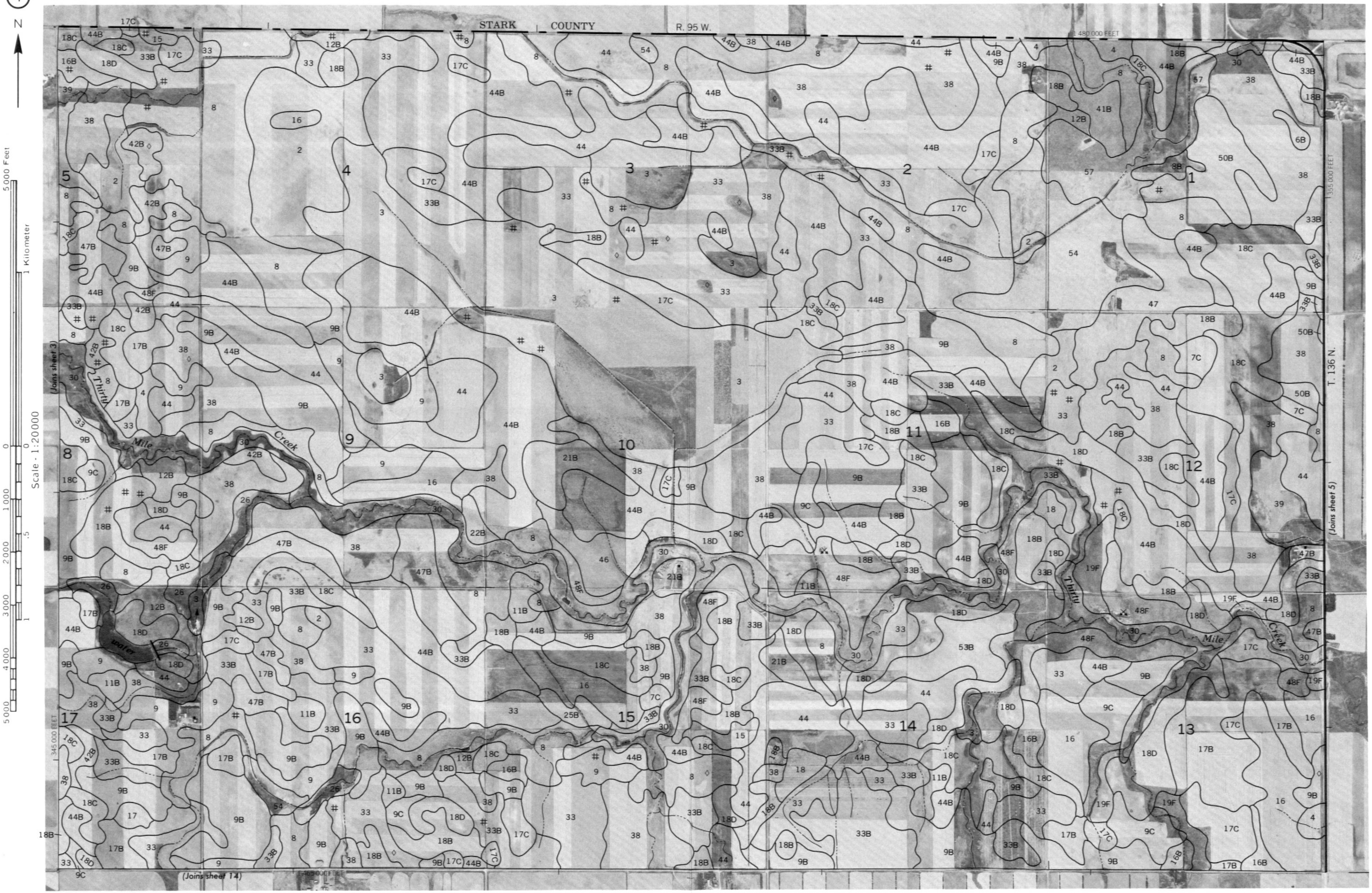
1 460 000 FEET
N
5 000 Feet
1 Kilometer
Scale - 1:20000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STARK COUNTY
R. 95 W.
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335 000 FEET
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T. 136 N.
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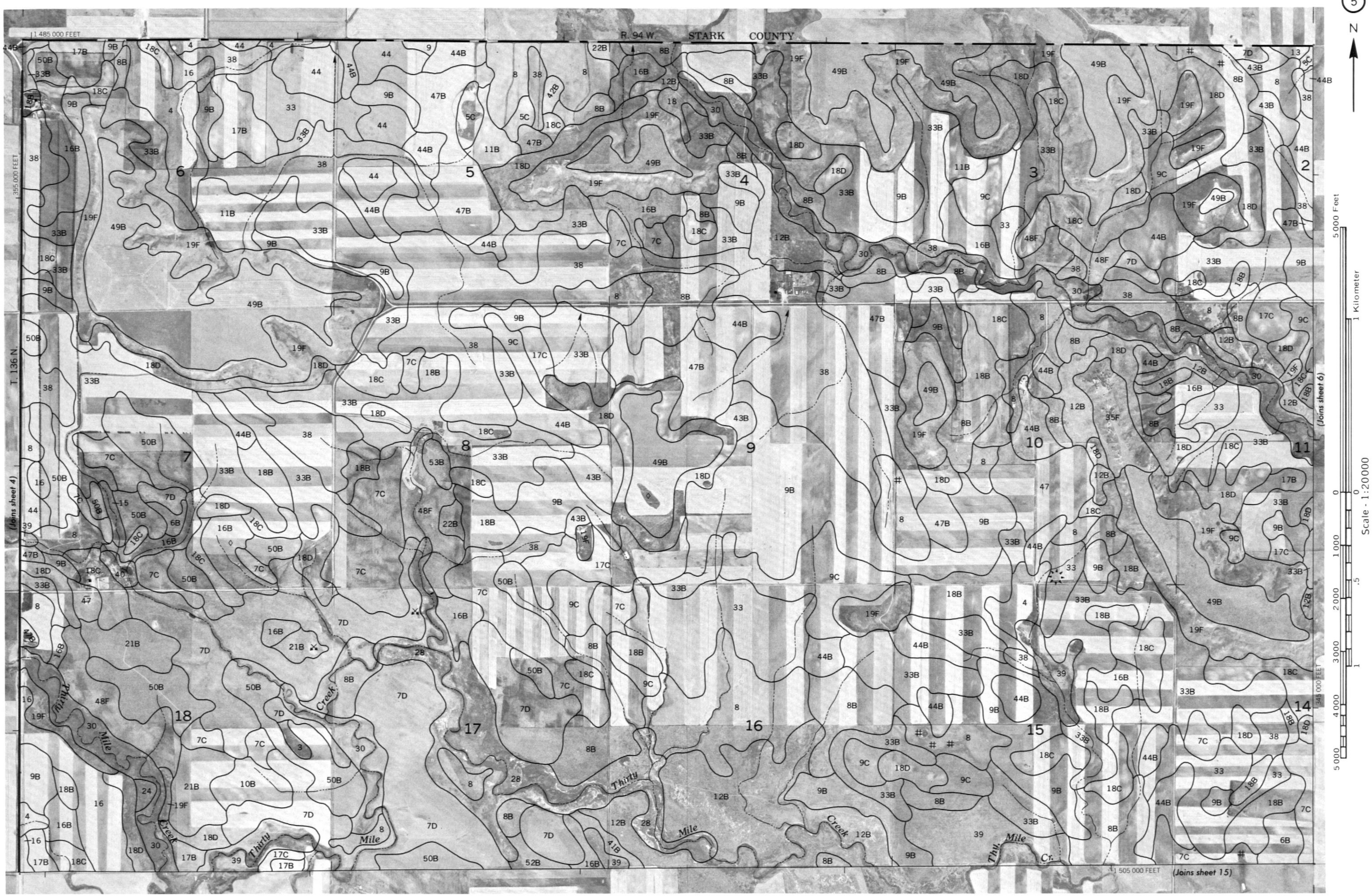
(Joins sheet 5)
(Joins sheet 14)
Thirty Mile Creek
water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R. 94 W.
STARK COUNTY
T. 136 N.
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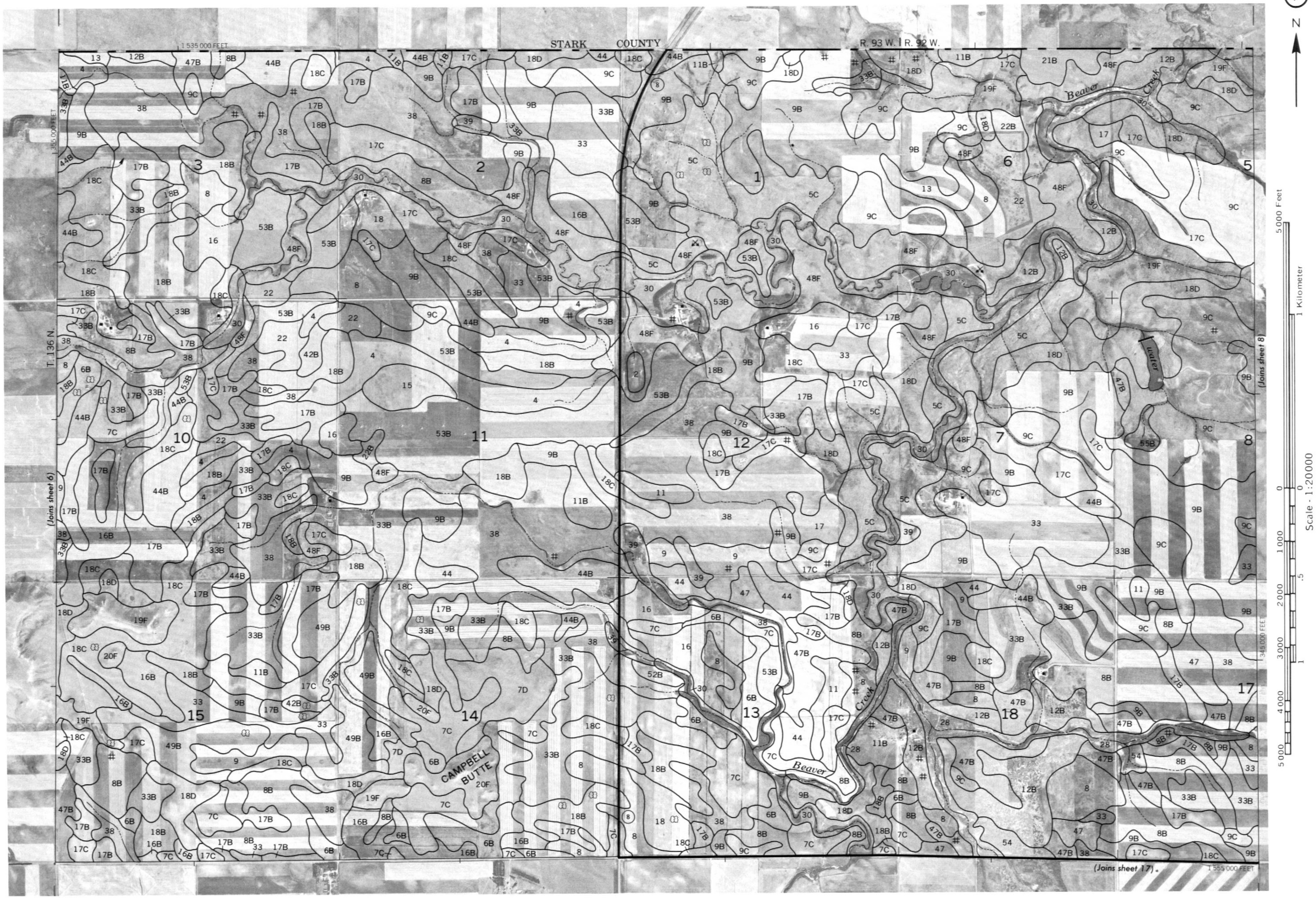
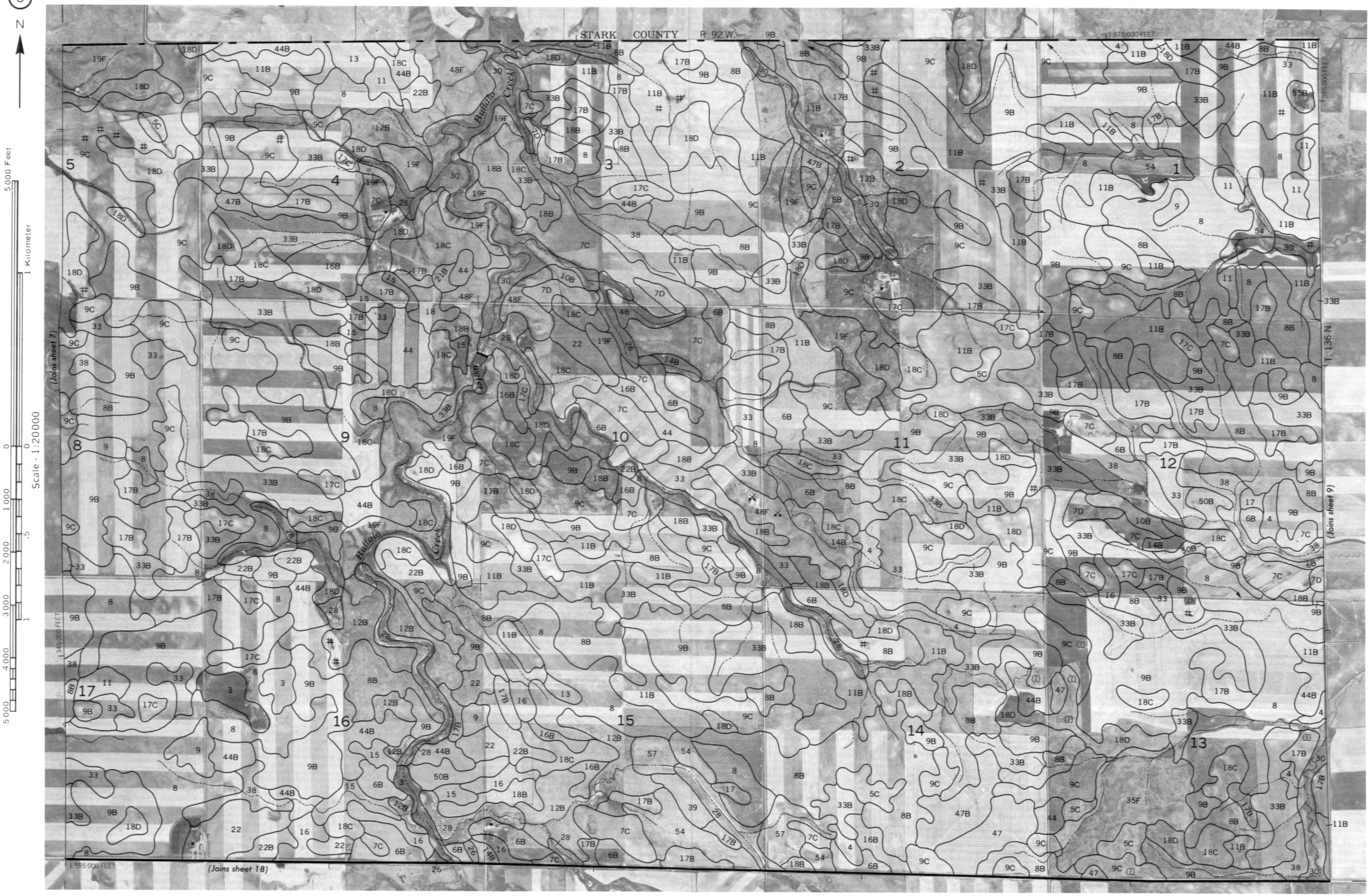
355 000 FEET
1 505 000 FEET
345 000 FEET
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 15)
Thirty Mile Creek
Thirty Mile Cr.
5 000 Feet
1 Kilometer
Scale - 1:20000

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1975 aerial photography. Coordinate grid

HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 7

7

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5000 Feet
1 Kilometer
Scale 1:20000
STARK COUNTY
R. 92 W.
1 575 000 FEET
Buffalo Creek
Buffalo Creek
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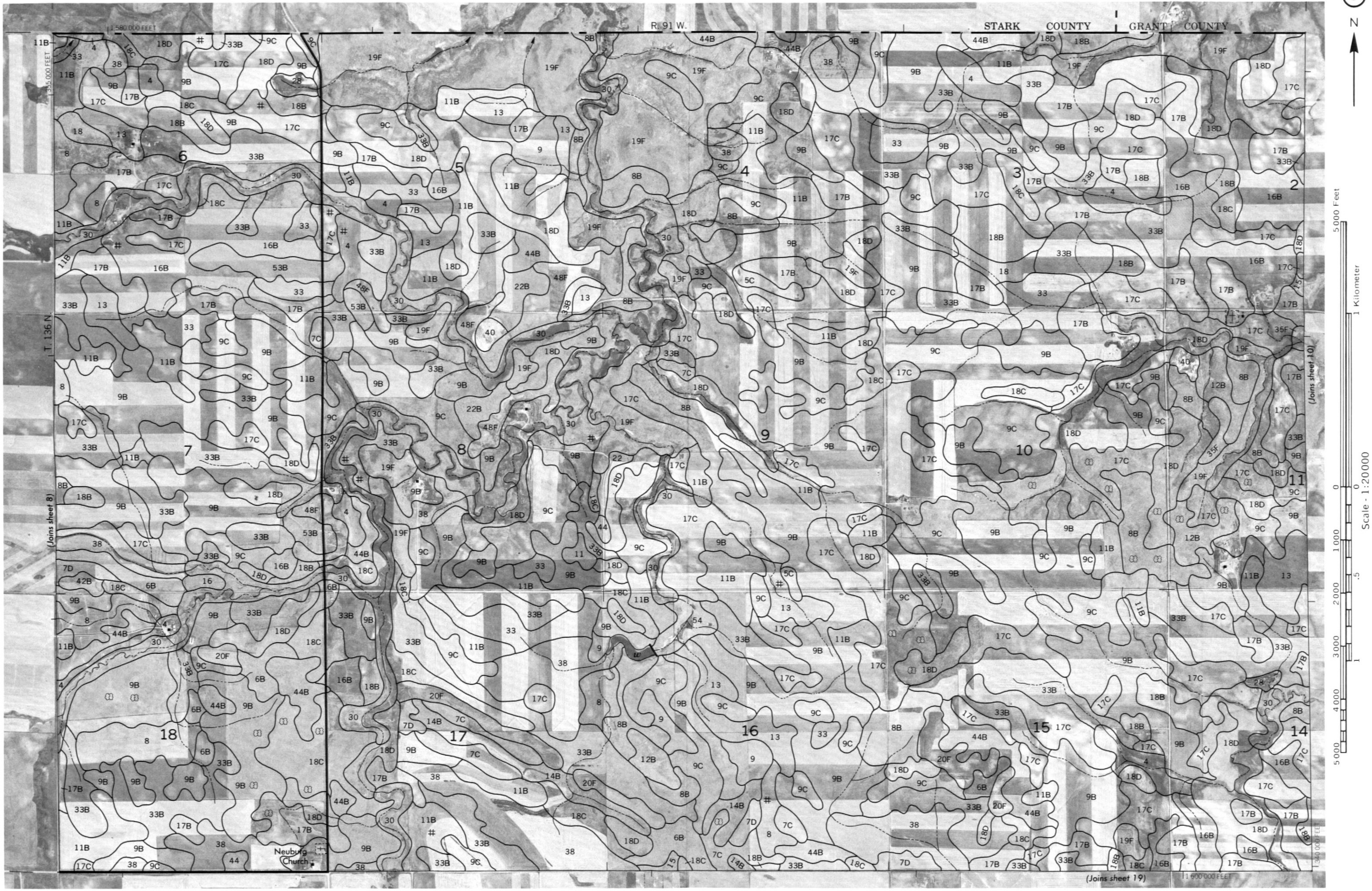
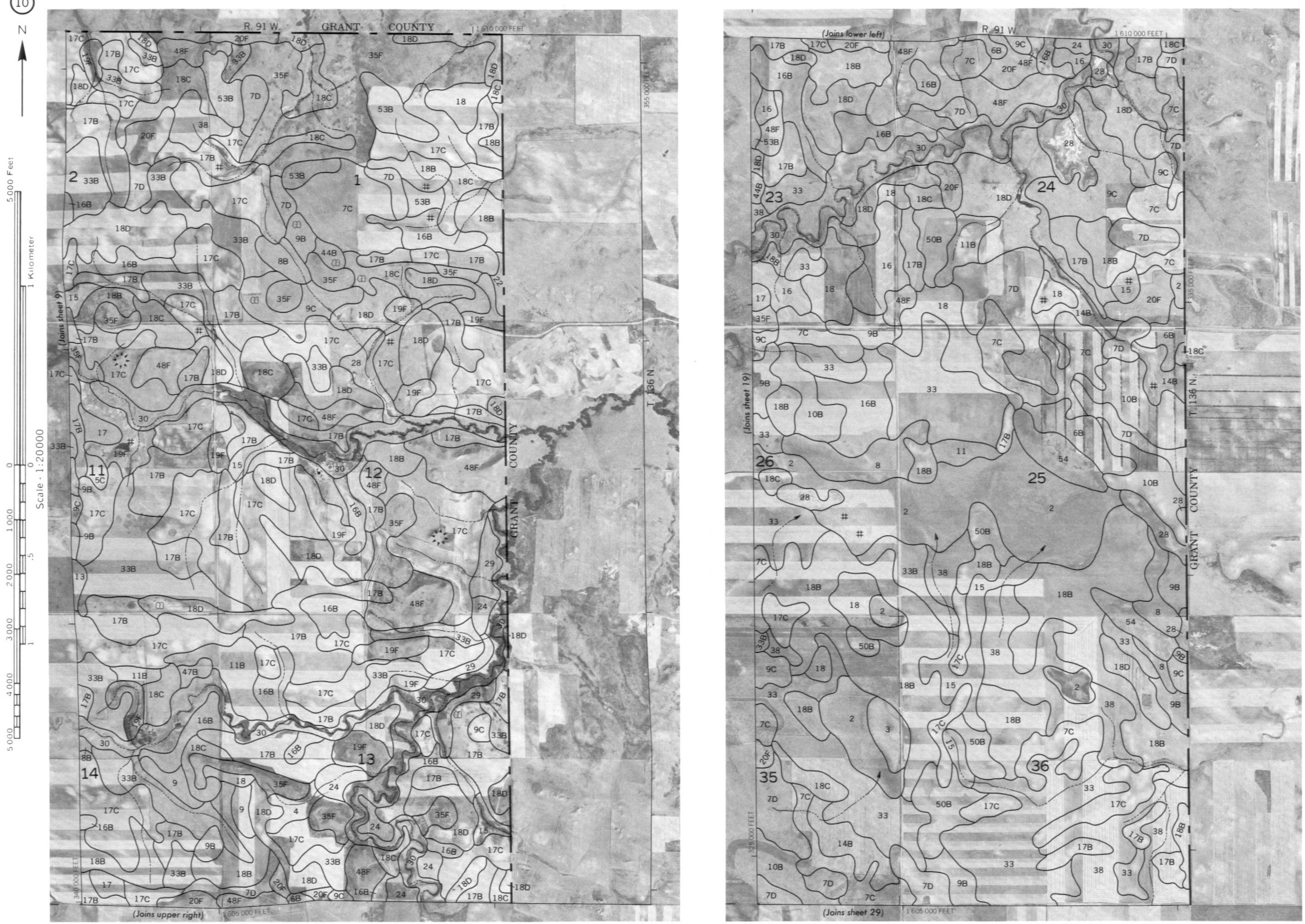
(Joins sheet 9)
(Joins sheet 18)
T. 136 N.
345 000 FEET
355 000 FEET
1 555 000 FEET


9
N
R. 91 W.
STARK COUNTY
GRANT COUNTY
T. 136 N.
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 19)
Neuburg Church
1 580 000 FEET
1 600 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000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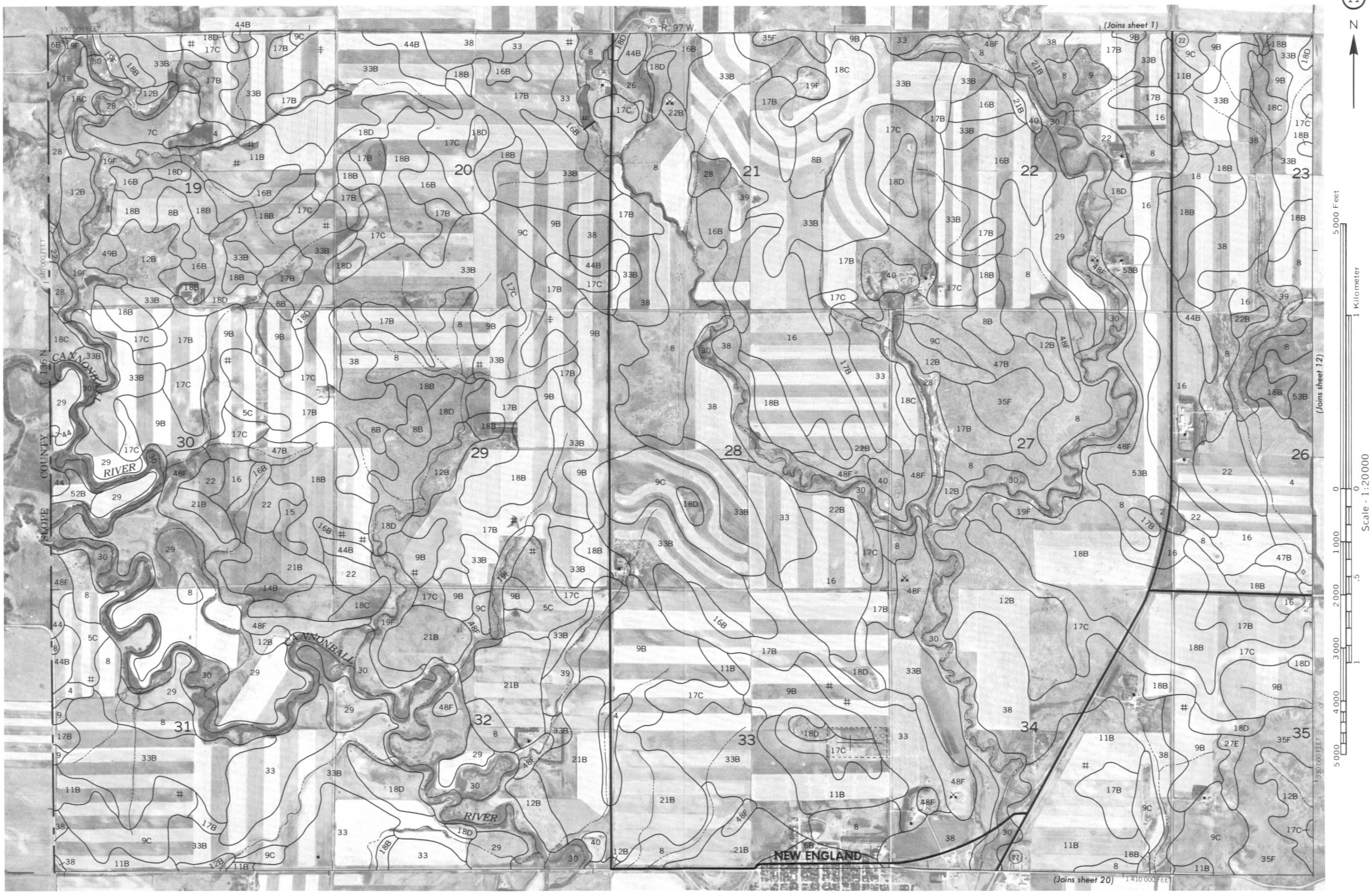
5000 Feet
1 Kilometer
Scale - 1:20000
R. 91 W.
GRANT COUNTY
1 610 000 FEET
355 000 FEET
(Joins sheet 9)
T. 136 N.
GRANT COUNTY
340 000 FEET
(Joins upper right)
1 605 000 FEET
(Joins lower left)
R. 91 W.
1 610 000 FEET
335 000 FEET
(Joins sheet 19)
T. 136 N.
GRANT COUNTY
325 000 FEET
(Joins sheet 29)
1 605 000 FEET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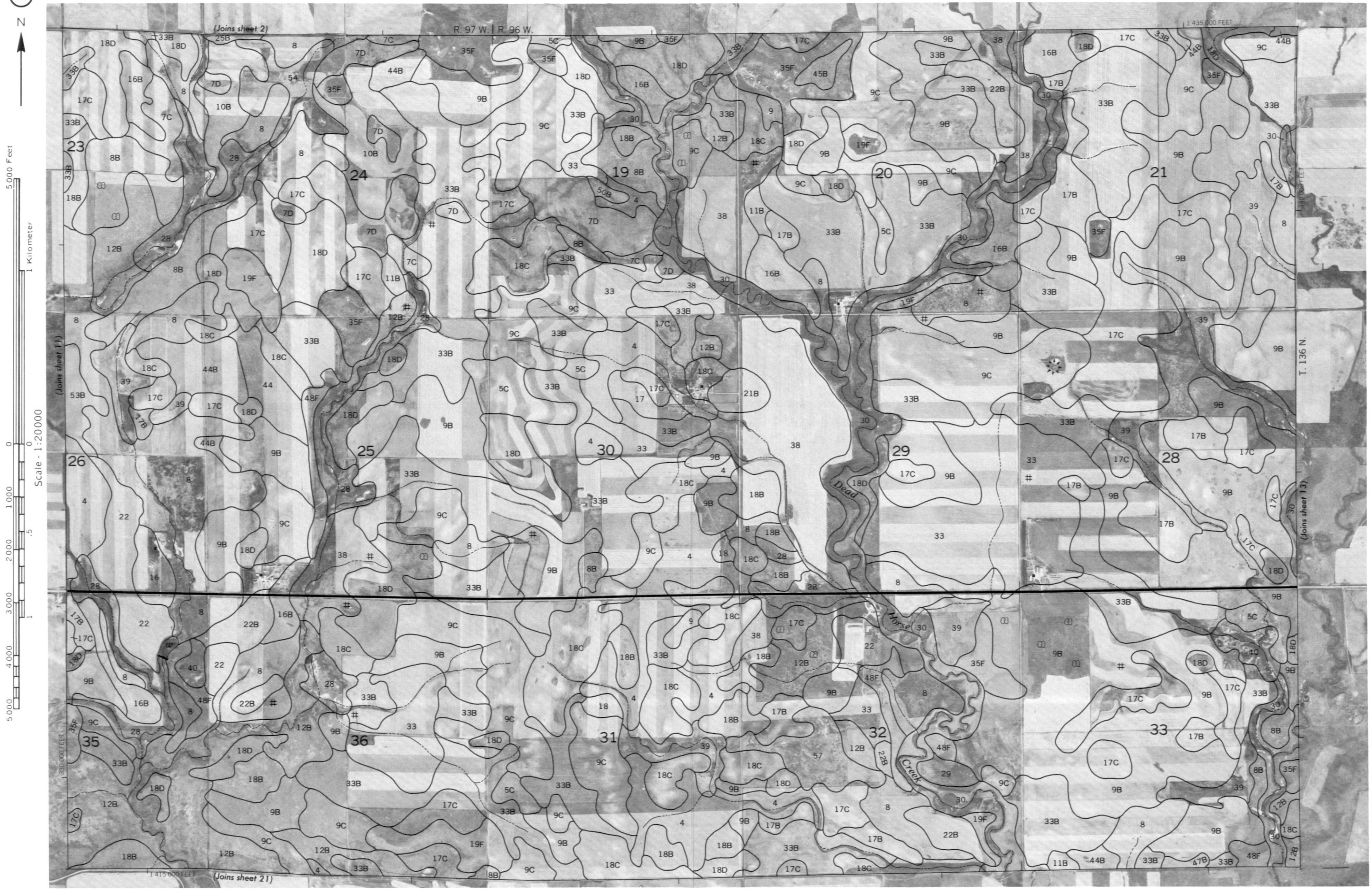
340 000 FEET
T. 136 N.
SLOPE COUNTY
CANNONBALL
RIVER
CANNONBALL
RIVER
NEW ENGLAND
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
(Joins sheet 12)
(Joins sheet 20)
1 410 000 FEET
330 000 FEET
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
0
.5
1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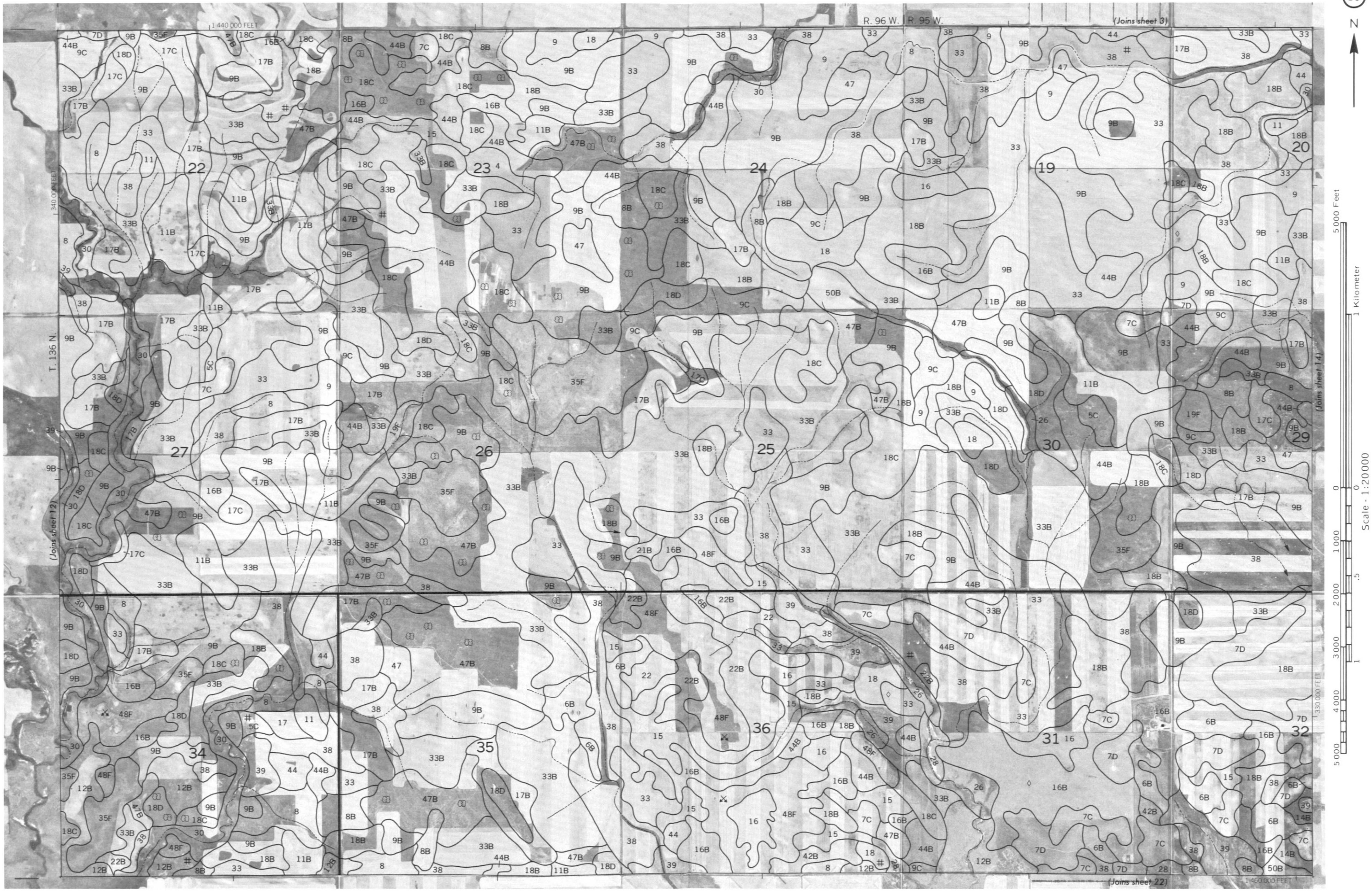
5 000 Feet
1 Kilometer
Scale 1:20 000
0
1000
2000
3000
4000
5000
0
.5
1
(Joins sheet 2)
R. 97 W. | R. 96 W.
1 435 000 FEET
(Joins sheet 11)
T. 136 N.
(Joins sheet 13)
1 415 000 FEET
(Joins sheet 21)
Dead
Horse
Creek
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36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R. 96 W.
R. 95 W.
T. 136 N.
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 22)
1 440 000 FEET
1 460 000 FEET
340 000 FEET
330 000 FEET
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
N
5000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale 1:20 000
(Joins sheet 4)
R. 95 W.
1 480 000 FEET
340 000 FEET
T. 136 N.
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 23)
1 465 000 FEET
330 000 FEET
Zion Church
20
21
22
23
24
29
28
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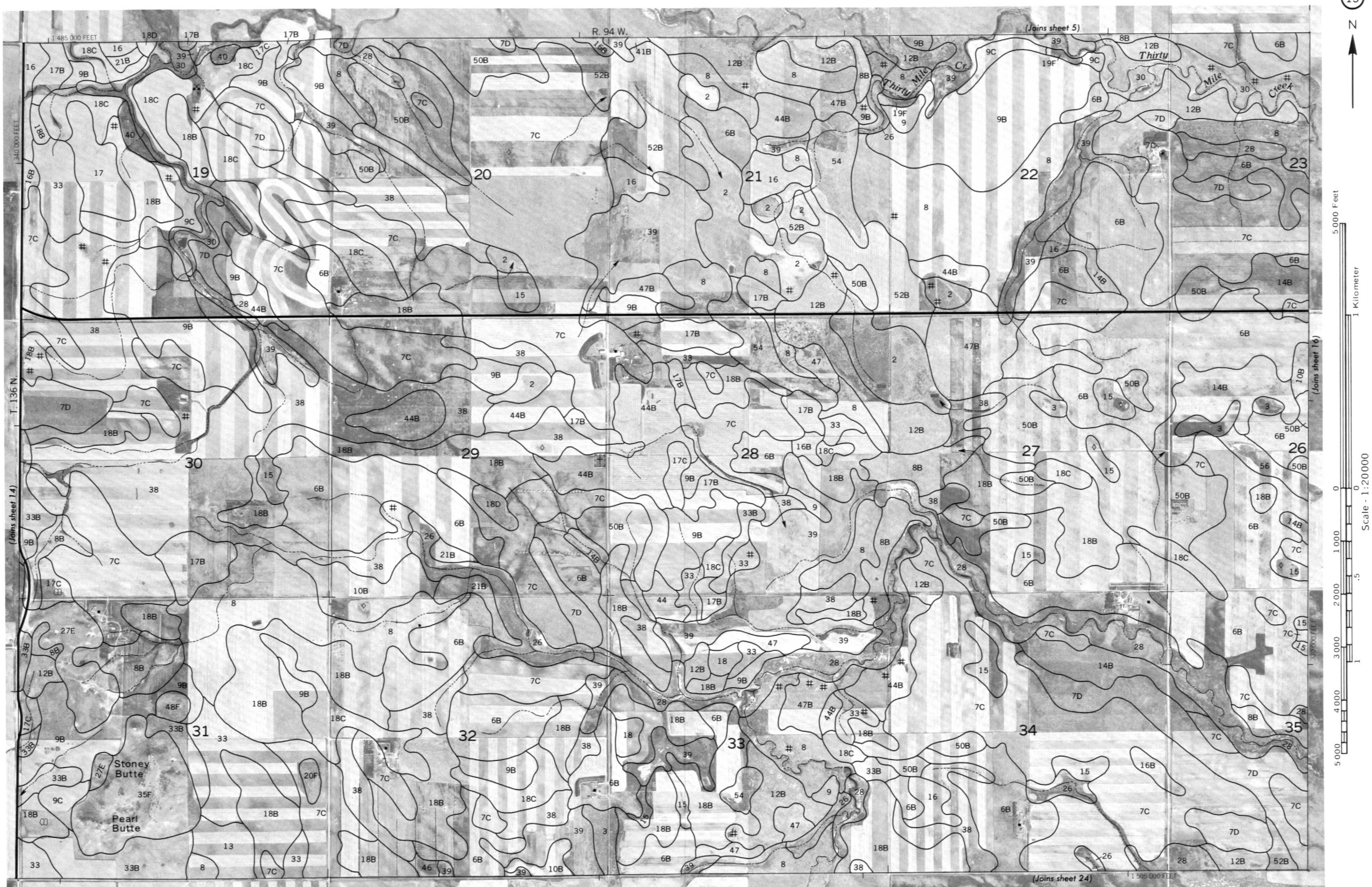
32
33
34
35
36


15
N
R. 94 W.
(Joins sheet 5)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 24)
T. 136 N.
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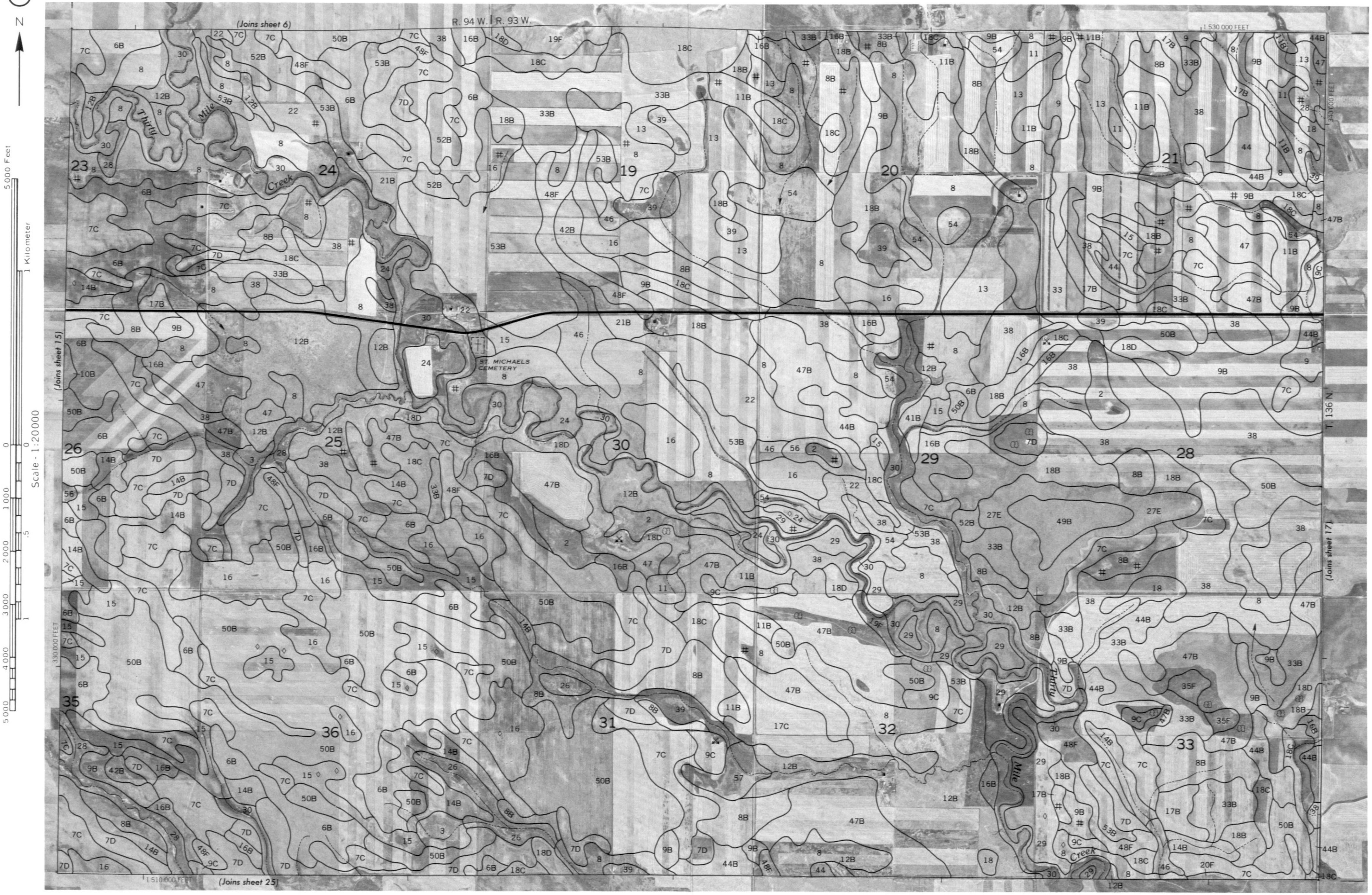
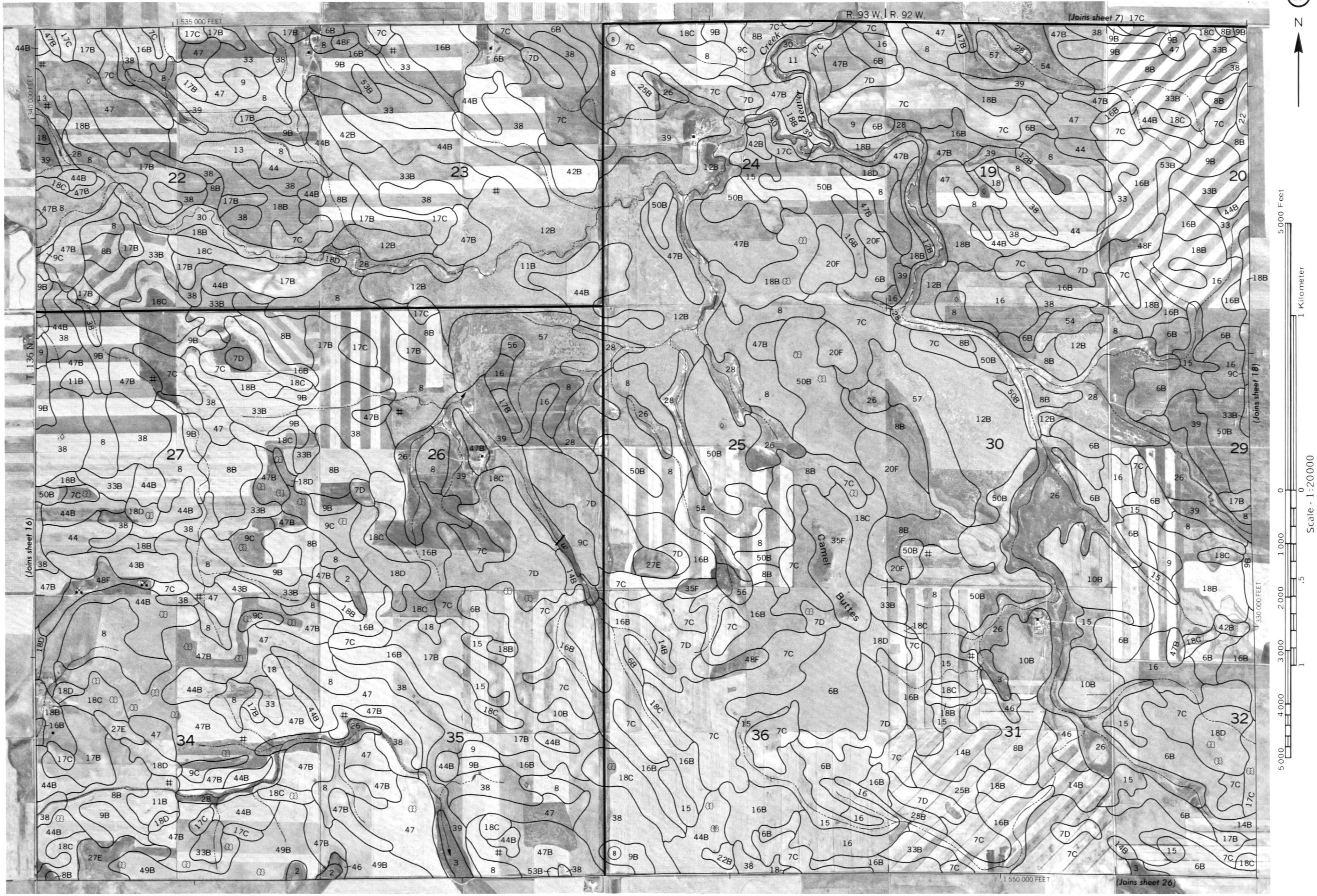
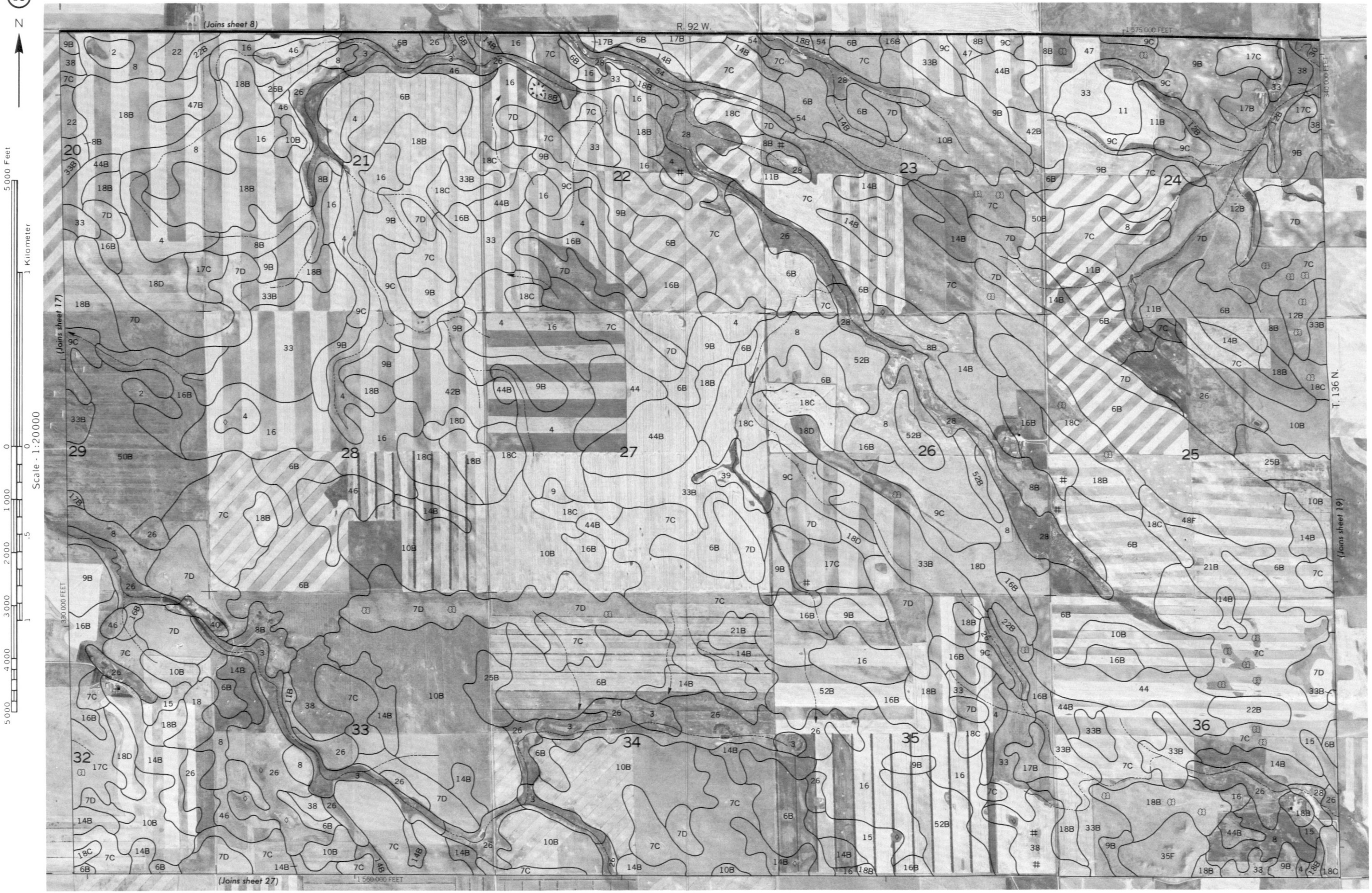
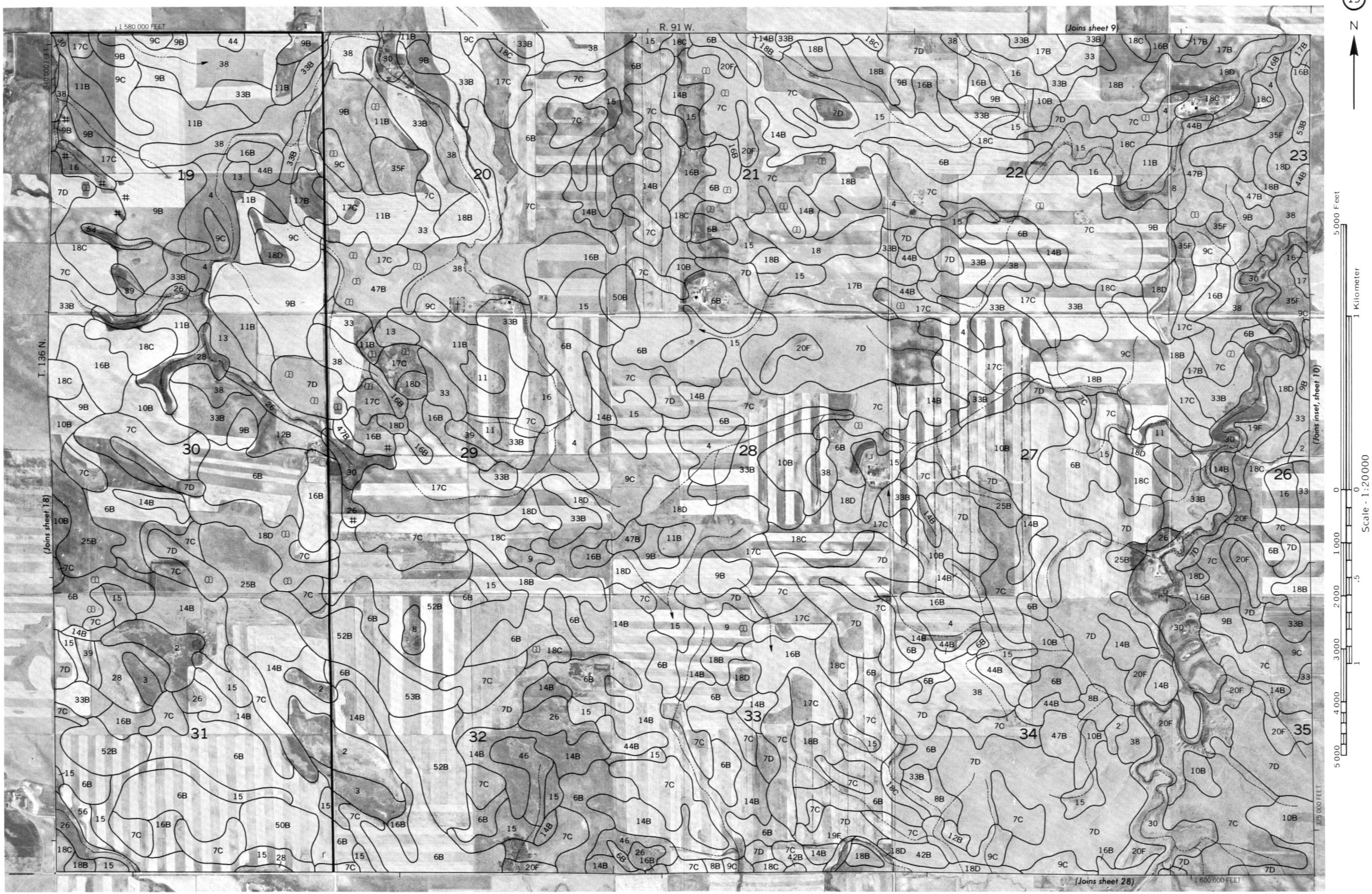
1 505 000 FEET
340 000 FEET
320 000 FEET
Thirty Mile Cr.
Thirty Mile Creek
Stoney Butte
Pearl Butte
5000 Feet
1 Kilometer
Scale - 1:20000

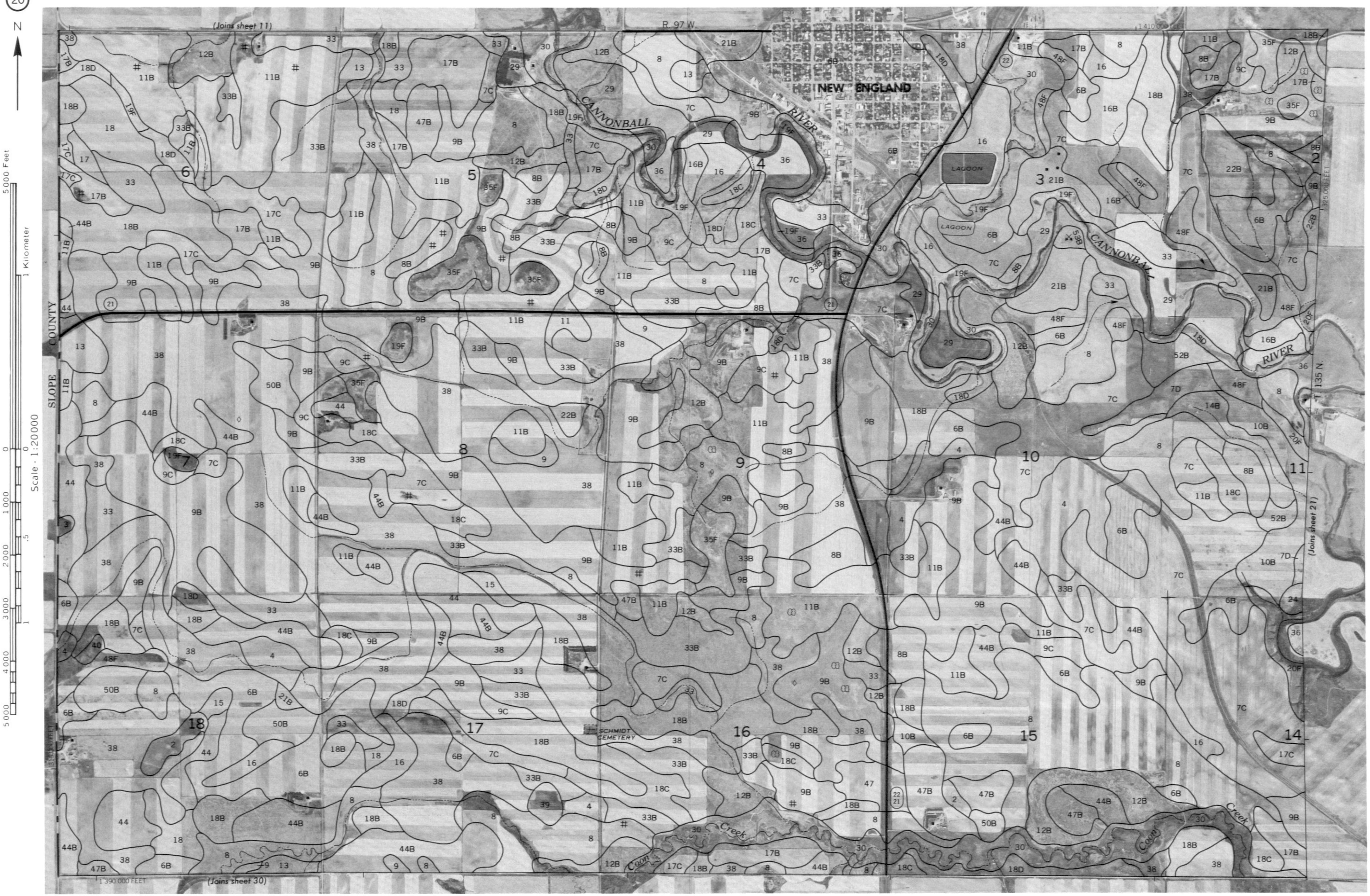

N
(Joins sheet 6)
R. 94 W. | R. 93 W.
1 530 000 FEET
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 25)
T. 136 N.
ST. MICHAELS CEMETERY
Thirty Mile Creek
330 000 FEET
1 510 000 FEET
5000 Feet
1 Kilometer
Scale 1:20000
0 1000 2000 3000 4000 5000
0 .5 1

17

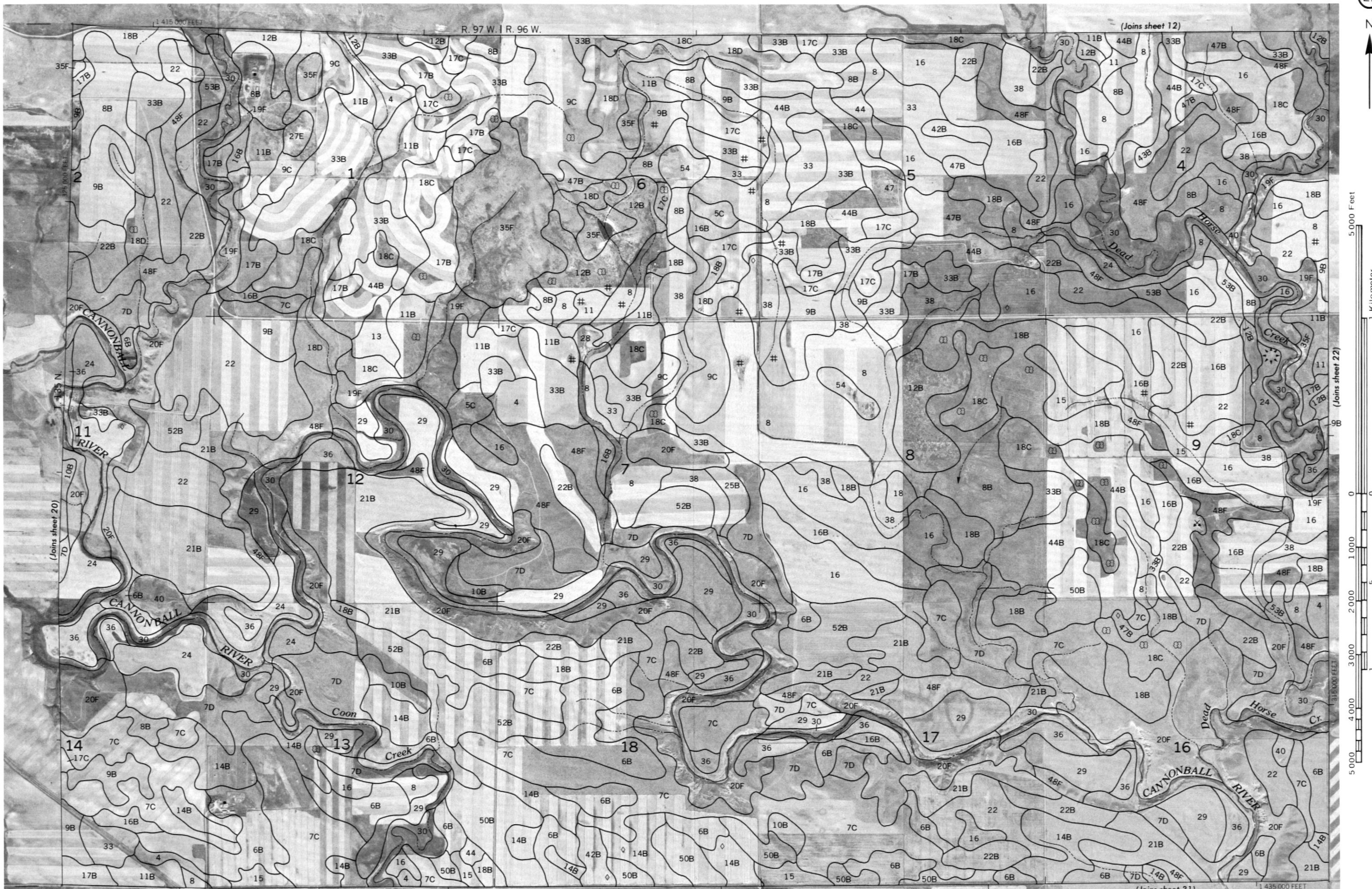

N
R. 93 W. | R. 92 W.
(Joins sheet 7)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 26)
T. 136 N.
1 535 000 FEET
1 550 000 FEET
340 000 FEET
330 000 FEET
Beaver Creek
Camel Buttes
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 8)
R. 92 W.
1 575 000 FEET
(Joins sheet 17)
(Joins sheet 19)
T. 136 N.
330 000 FEET
340 000 FEET
(Joins sheet 27)
1 560 000 FEET
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36

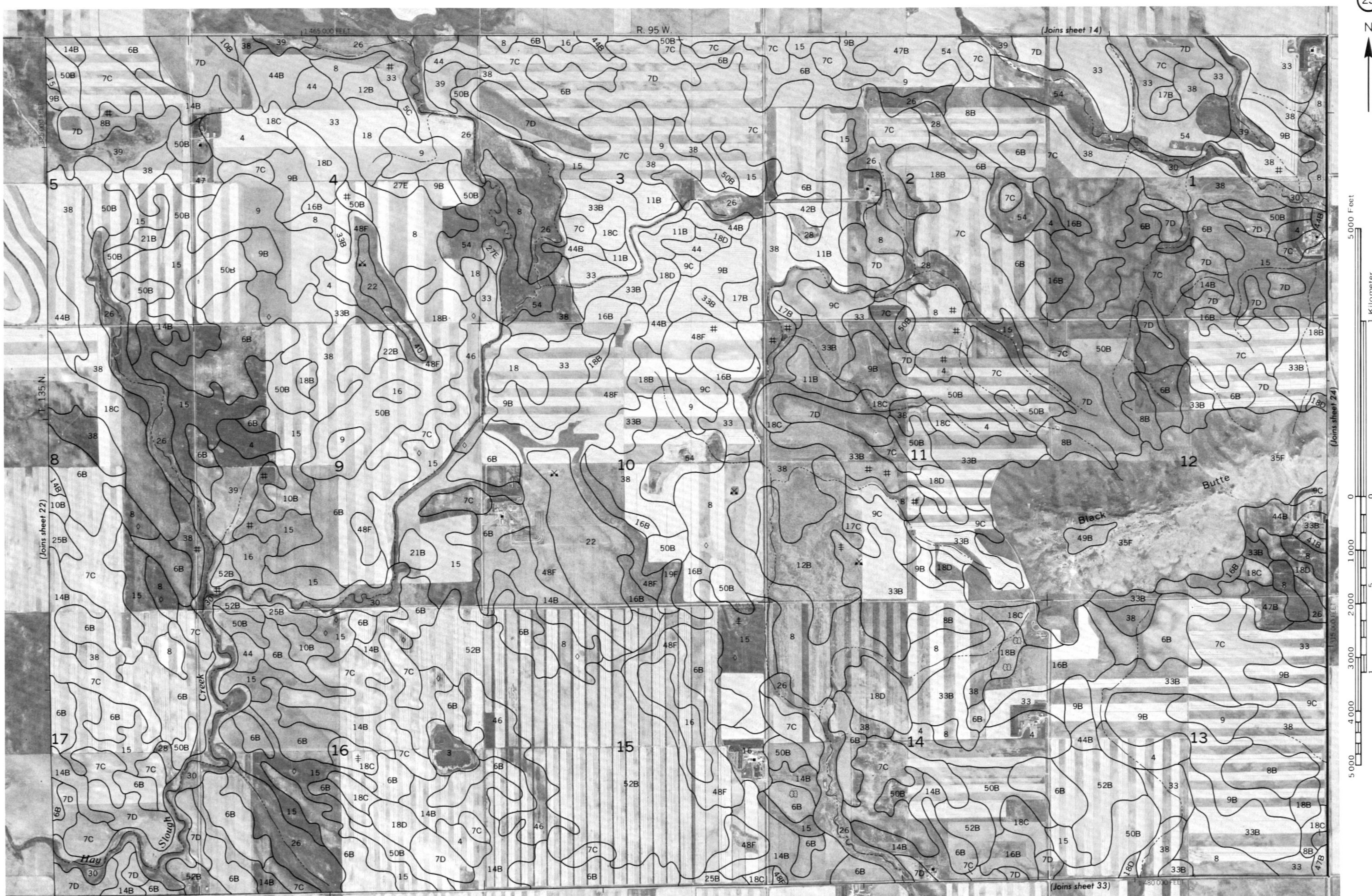

R. 91 W.
T. 136 N.
(Joins sheet 9)
(Joins sheet 18)
(Joins inset, sheet 10)
(Joins sheet 28)
1 580 000 FEET
1 600 000 FEET
340 000 FEET
325 000 FEET
N
5000 Feet
1 Kilometer
Scale - 1:20000
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35

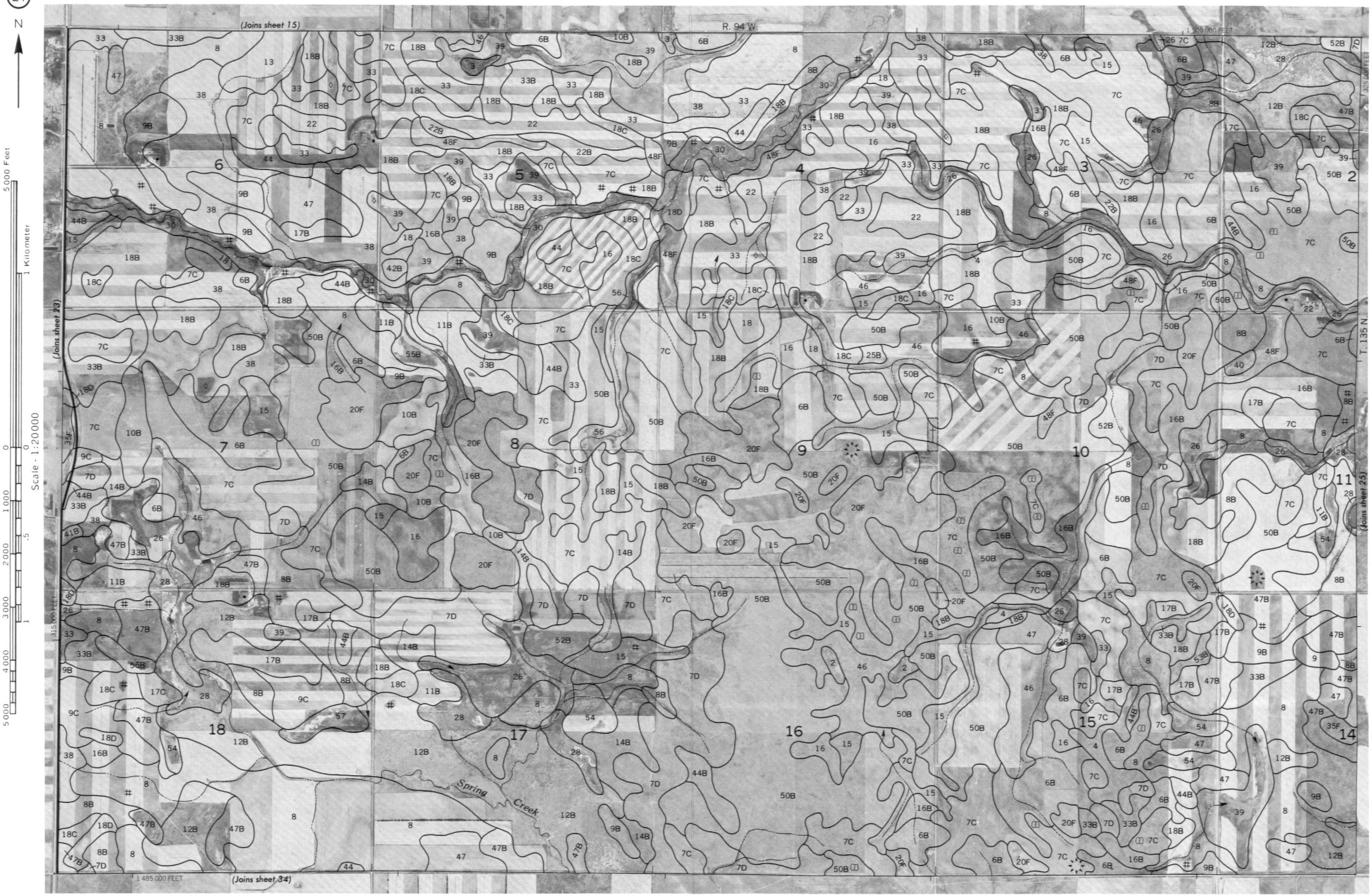

N
(Joins sheet 11)
R. 97 W.
NEW ENGLAND
CANNONBALL
RIVER
LAGOON
LAGOON
SLOPE COUNTY
135 N.
(Joins sheet 21)
(Joins sheet 30)
SCHMIDT CEMETERY
Coon Creek
5000 Feet
1 Kilometer
Scale 1:20000
1 410 000 FEET
1 390 000 FEET

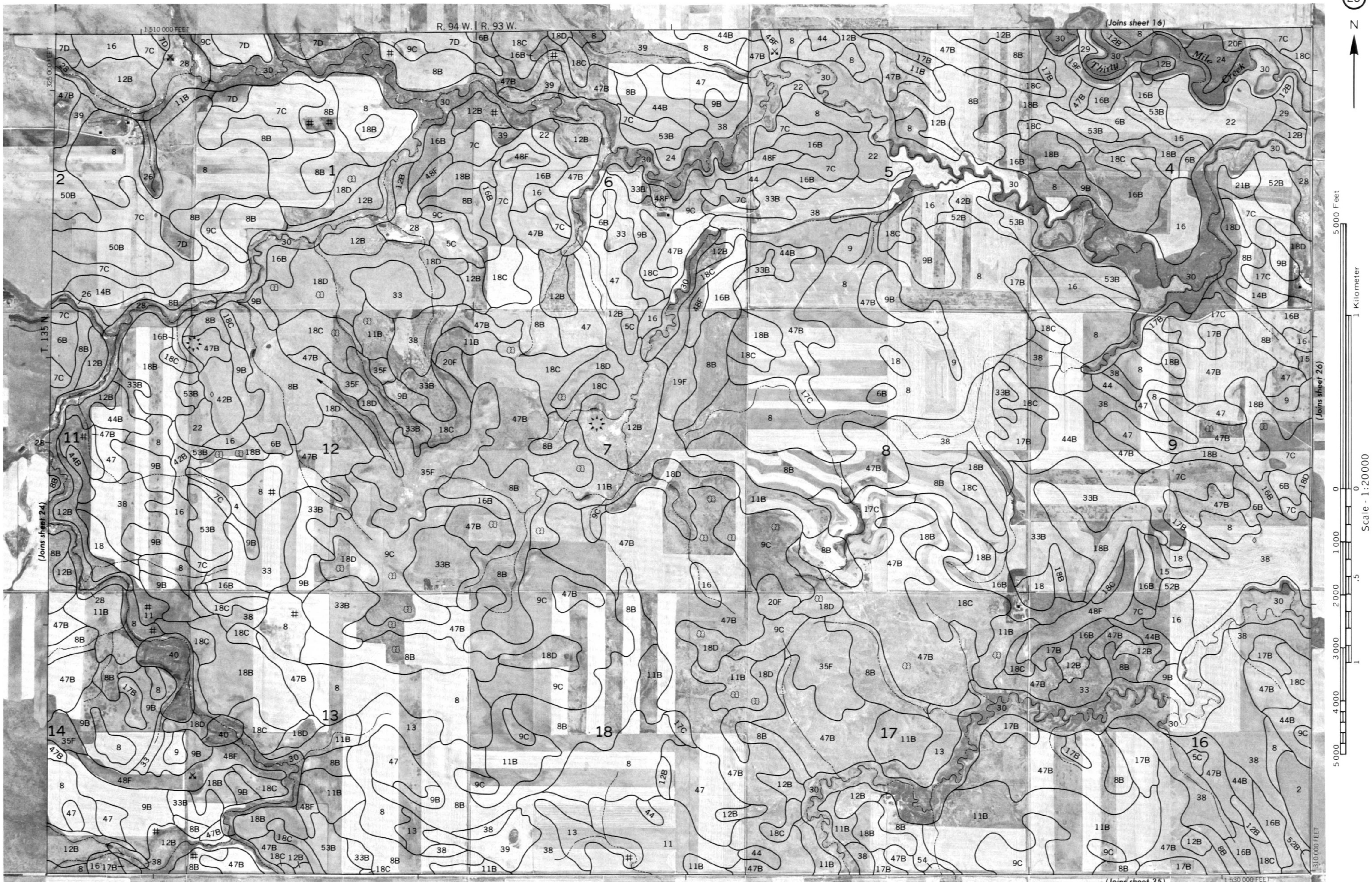
HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 21

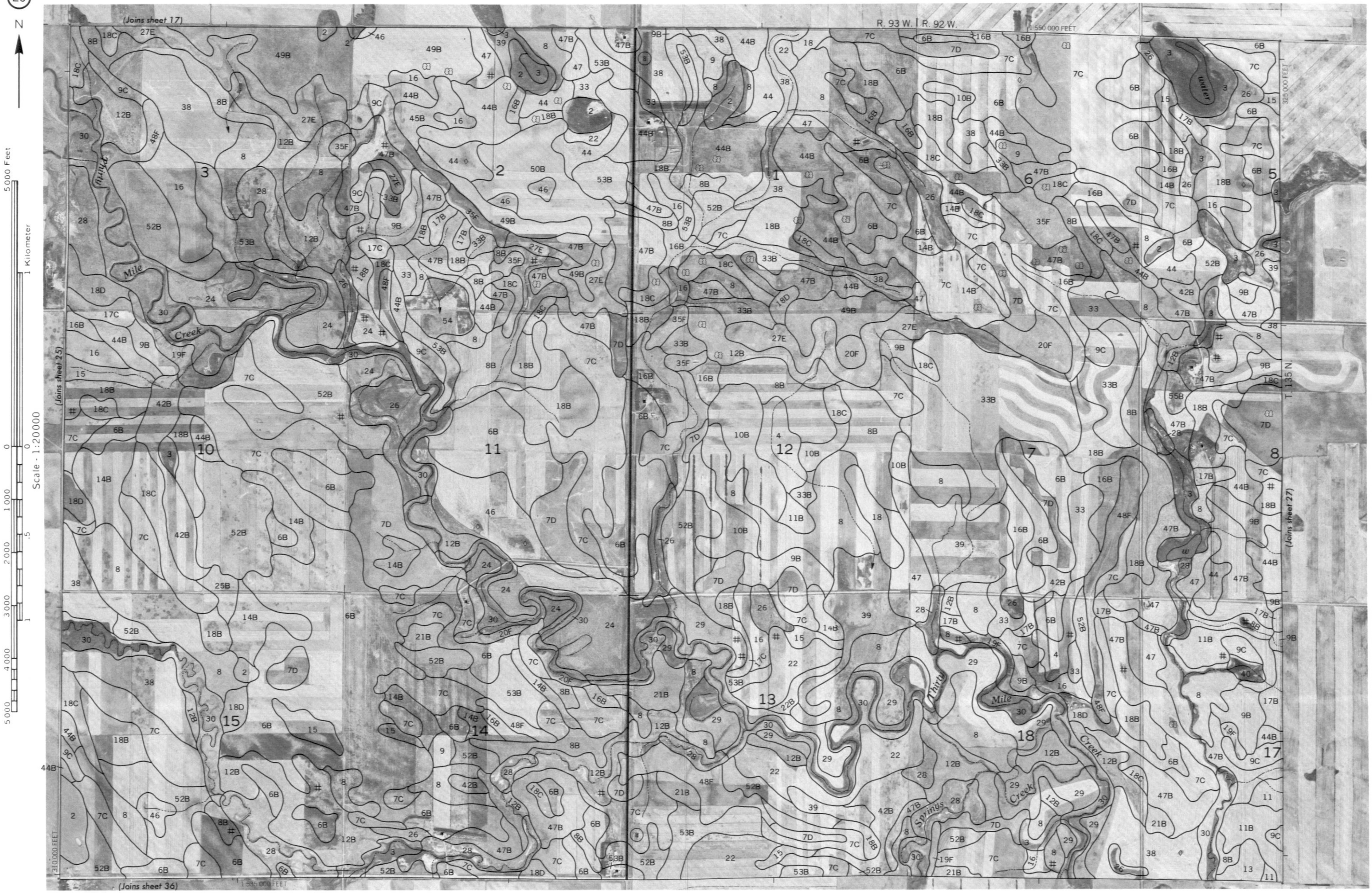


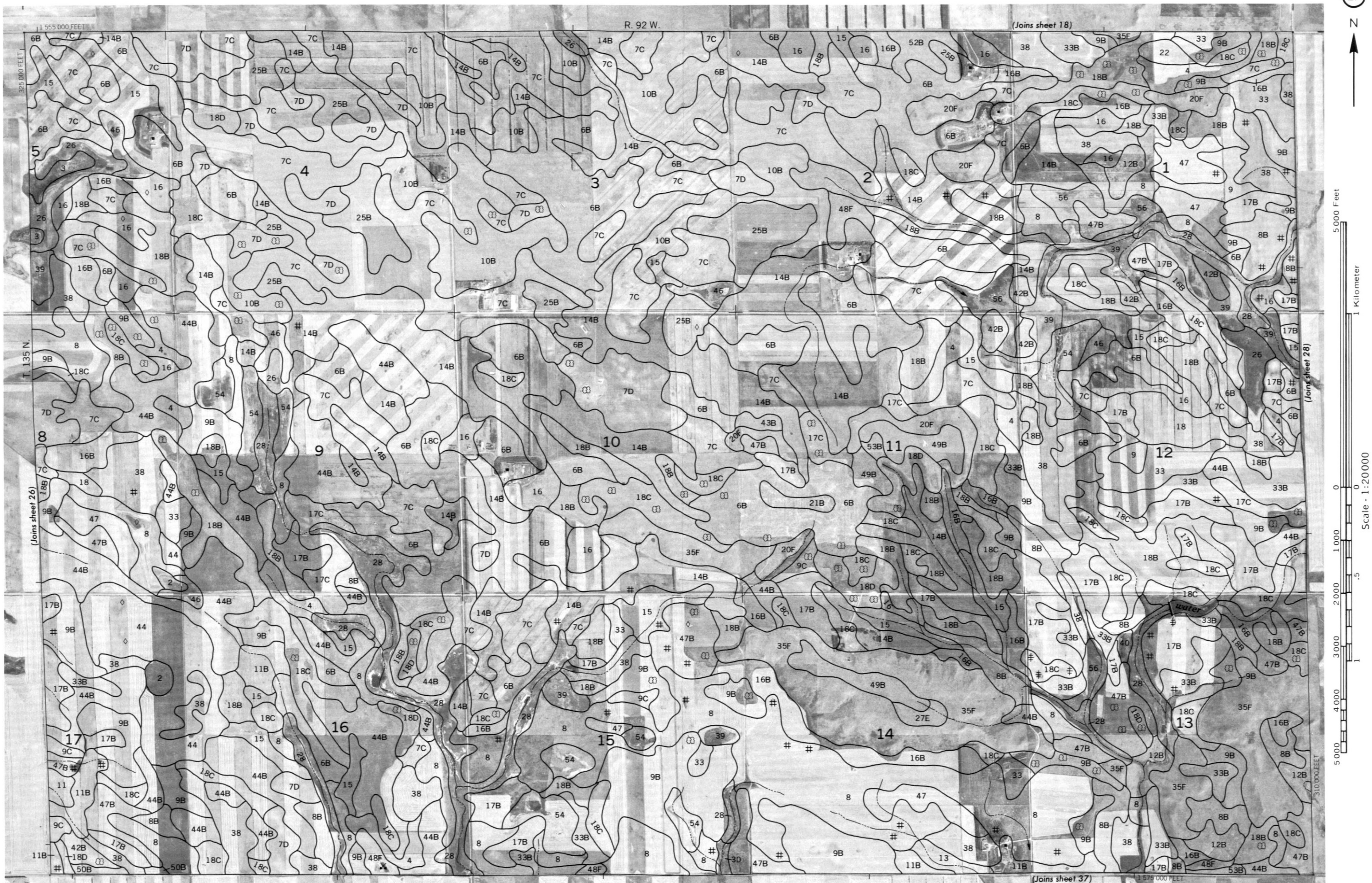

N
(Joins sheet 13)
R. 96 W. | R. 95 W.
1 460 000 FEET
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 32)
1 440 000 FEET
T. 135 N.
5 000 Feet
1 Kilometer
Scale - 1:20000
Horse
Creek
Dead
Hay
Slough
Creek
water

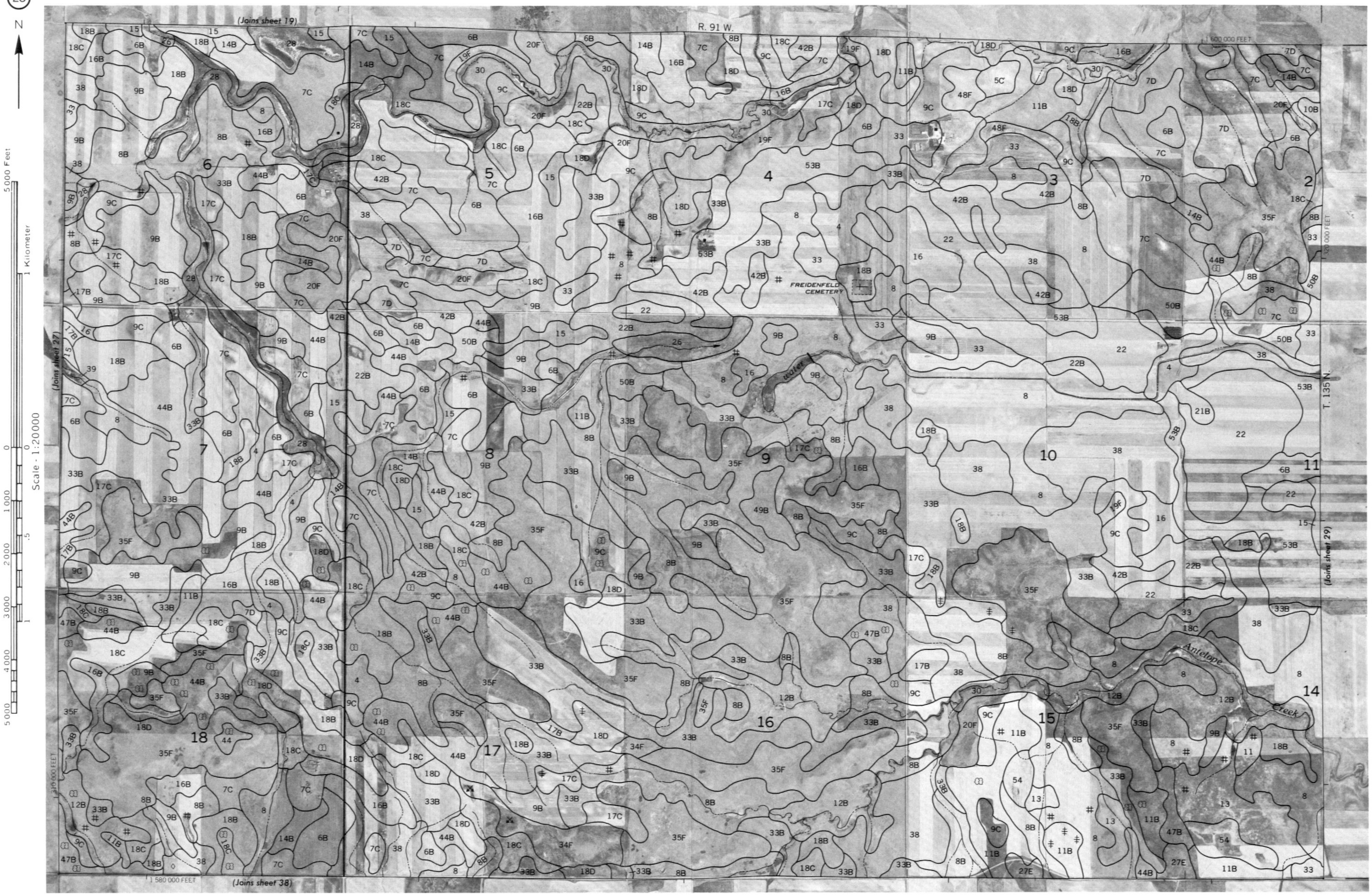

R. 95 W.
1 465 000 FEET
(Joins sheet 14)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 33)
T. 135 N.
1 480 000 FEET
Black
Butte
Hay
Slough
Creek
N
5000 Feet
1 Kilometer
Scale - 1:20000
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

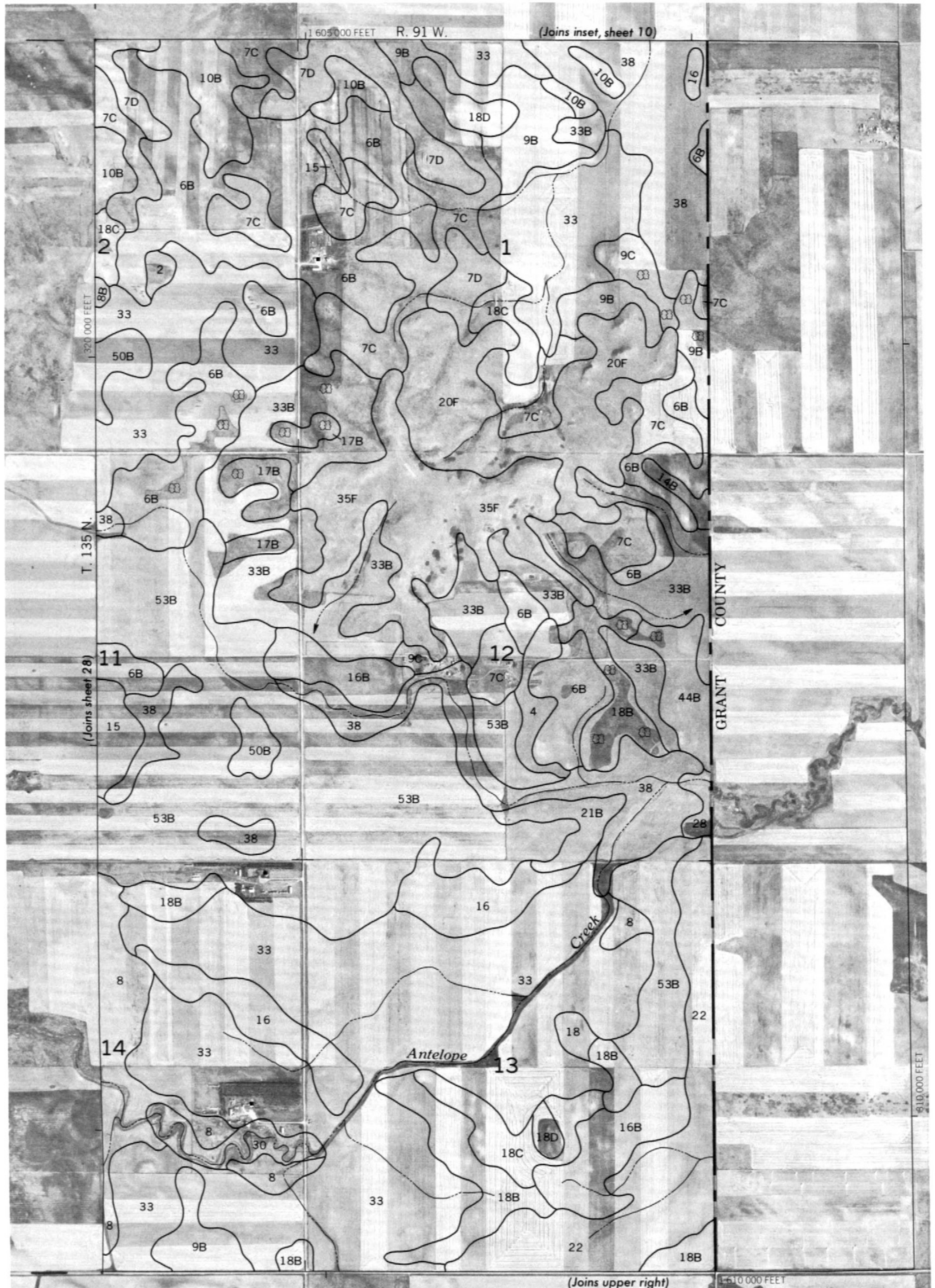

N
(Joins sheet 15)
R. 94 W.
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 34)
T. 135 N.
Spring Creek
1 485 000 FEET
1 505 000 FEET
315 000 FEET
5000 Feet
1 Kilometer
Scale - 1:20000

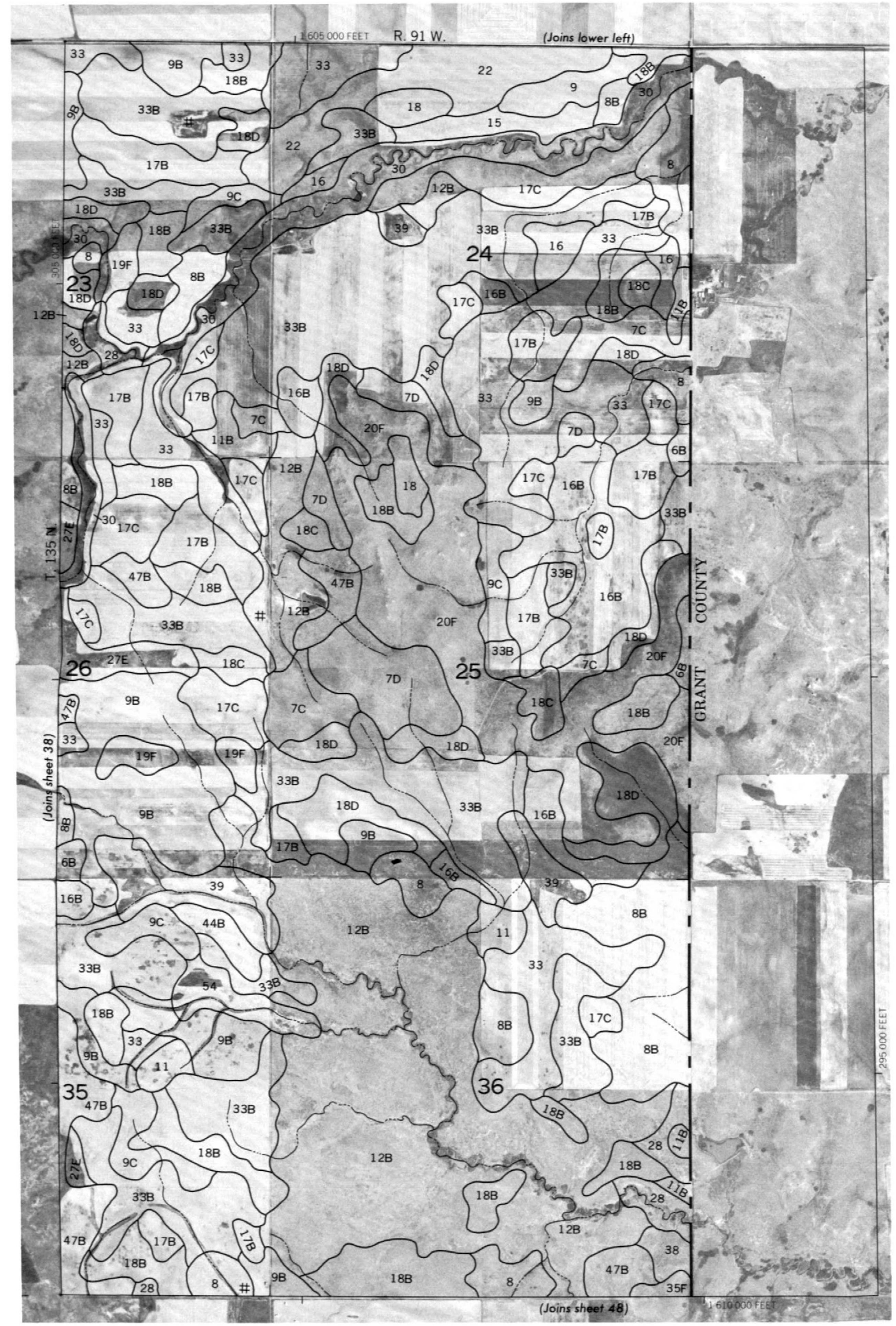

(Joins sheet 16)
(Joins sheet 35)
(Joins sheet 24)
(Joins sheet 26)
R. 94 W. | R. 93 W.
T. 135 N.
Thirty Mile Creek
1 510 000 FEET
1 530 000 FEET
325 000 FEET
310 000 FEET
N
5 000 Feet
1 Kilometer
Scale - 1:20000


26
N
(Joins sheet 17)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 36)
R. 93 W. | R. 92 W.
T. 135 N.
1 590 000 FEET
325 000 FEET
310 000 FEET
1 535 000 FEET
Thirty Mile Creek
Springs Creek
water
5 000 Feet
1 Kilometer
Scale 1:20000
0
1000
2000
3000
4000
5000
0
.5
1

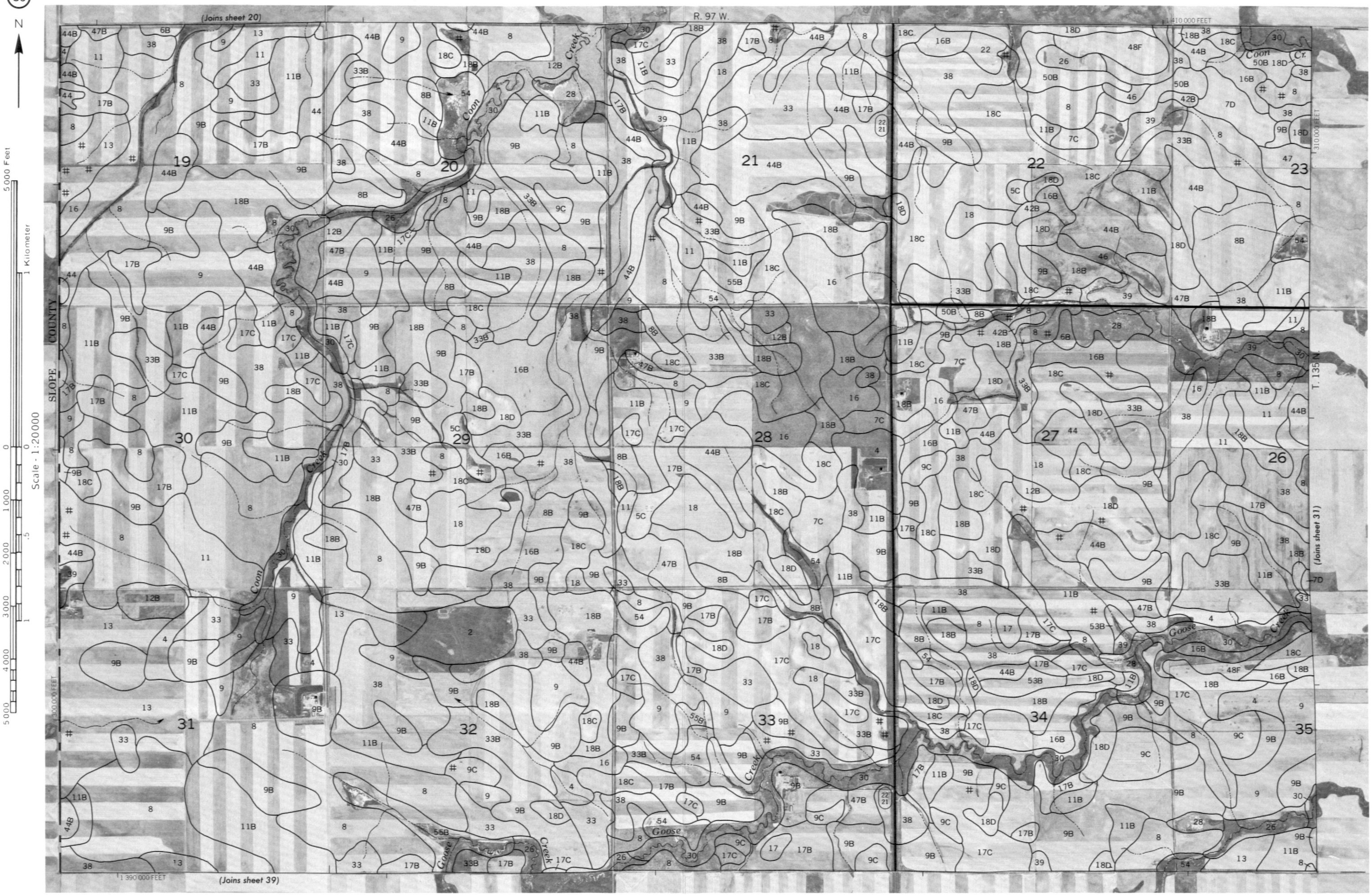

R. 92 W.
(Joins sheet 18)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 37)
T. 135 N.
1 555 000 FEET
325 000 FEET
310 000 FEET
1 575 000 FEET
water
N
5000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 19)
R. 91 W.
T. 135 N.
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 38)
FRIEDENFELD CEMETERY
water
Antelope
Creek
1 580 000 FEET
1 600 000 FEET
320 000 FEET
310 000 FEET


1 605 000 FEET
R. 91 W.
(Joins inset, sheet 10)
T. 135 N.
(Joins sheet 28)
GRANT
COUNTY
Antelope
Creek
(Joins upper right)
1 610 000 FEET

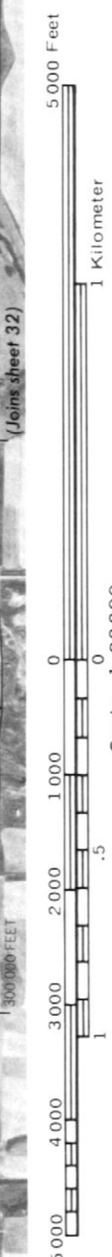

1 605 000 FEET
R. 91 W.
(Joins lower left)
T. 135 N.
(Joins sheet 38)
COUNTY
GRANT
(Joins sheet 48)
1 610 000 FEET


N
5 000 Feet
1 Kilometer
Scale - 1:20000

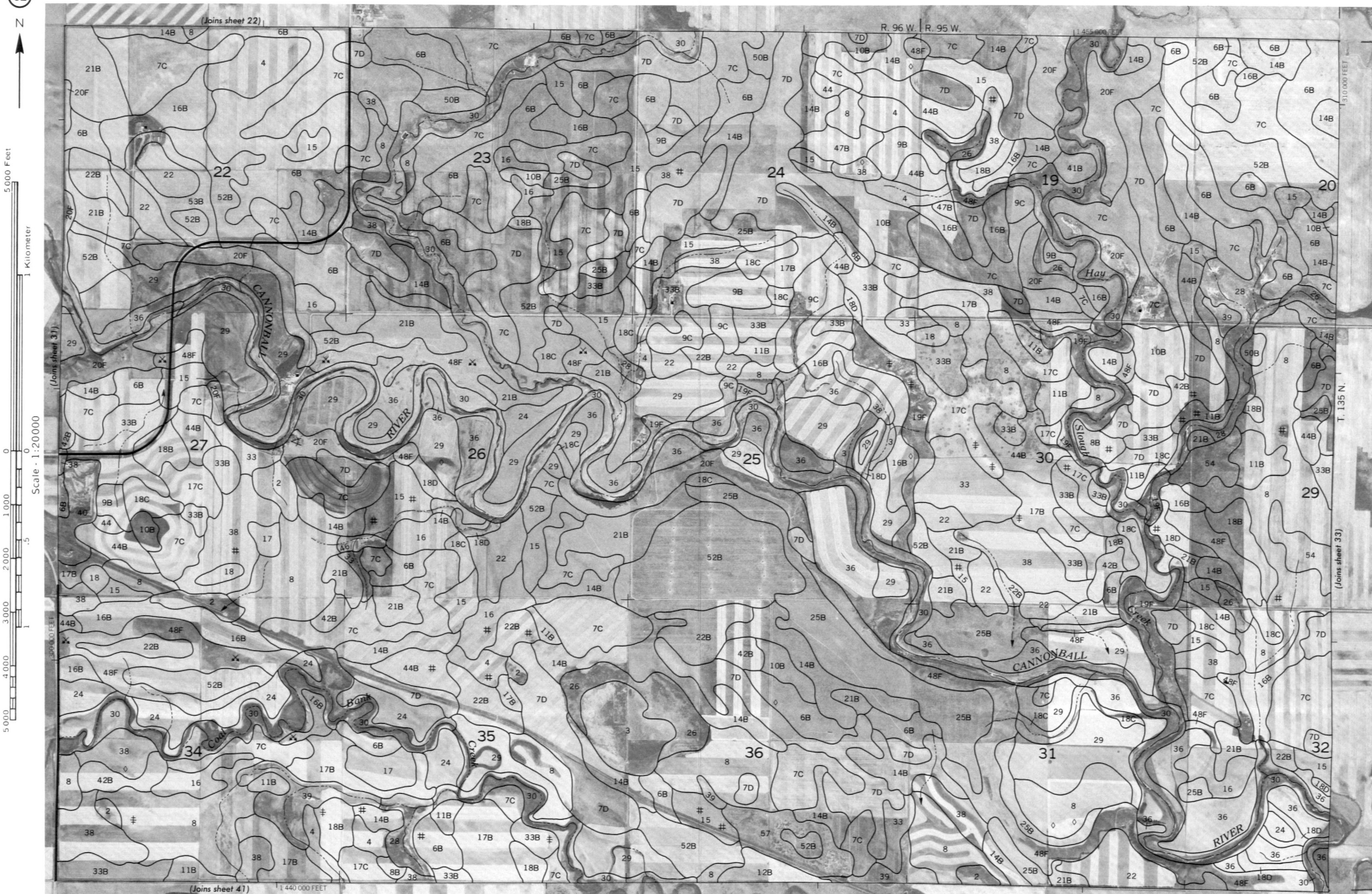

N
(Joins sheet 20)
R. 97 W.
410 000 FEET
310 000 FEET
T. 135 N.
(Joins sheet 31)
(Joins sheet 39)
1 390 000 FEET
300 000 FEET
SLOPE COUNTY
Coon Creek
Coon Cr.
Goose Creek
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
0
.5
1

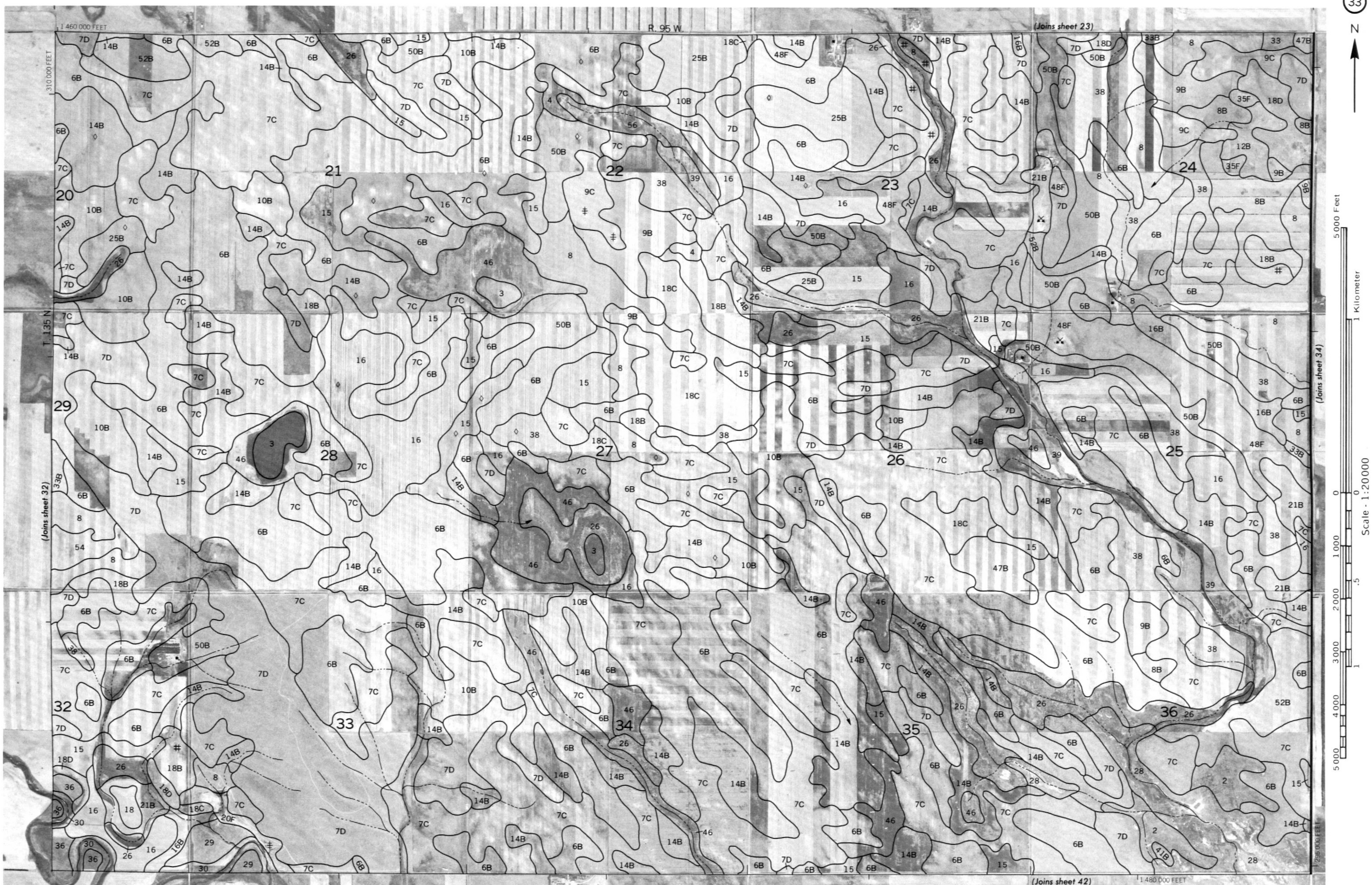
(Joins sheet 21)
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 40)
R. 97 W. | R. 96 W.
T. 135 N.
1 415 000 FEET
1 435 000 FEET
310 000 FEET
300 000 FEET
Coon Creek
CANNONBALL RIVER
Goose Creek
Coal Bank Creek
HAVELOCK CEMETERY
Havelock
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

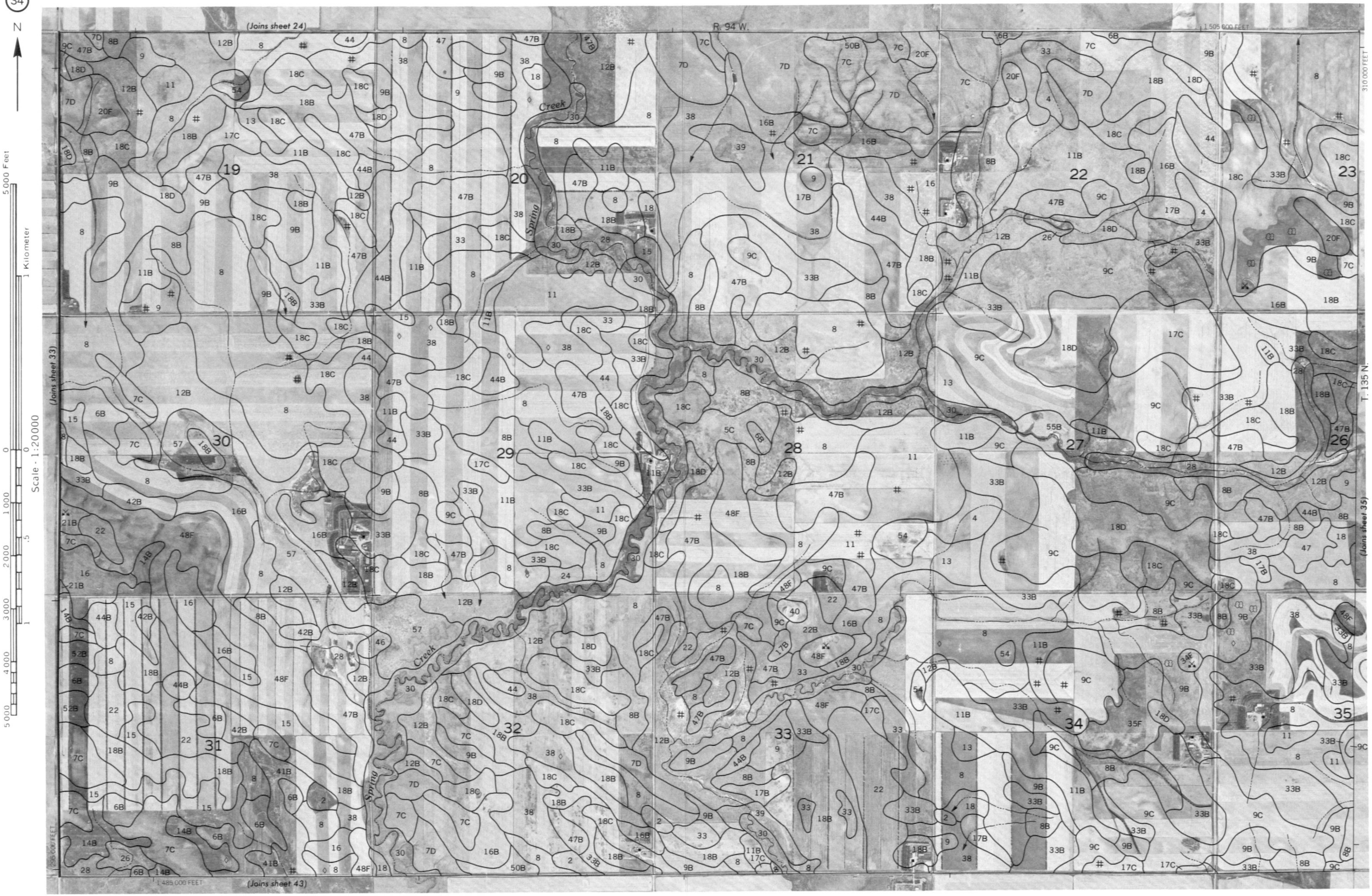
N

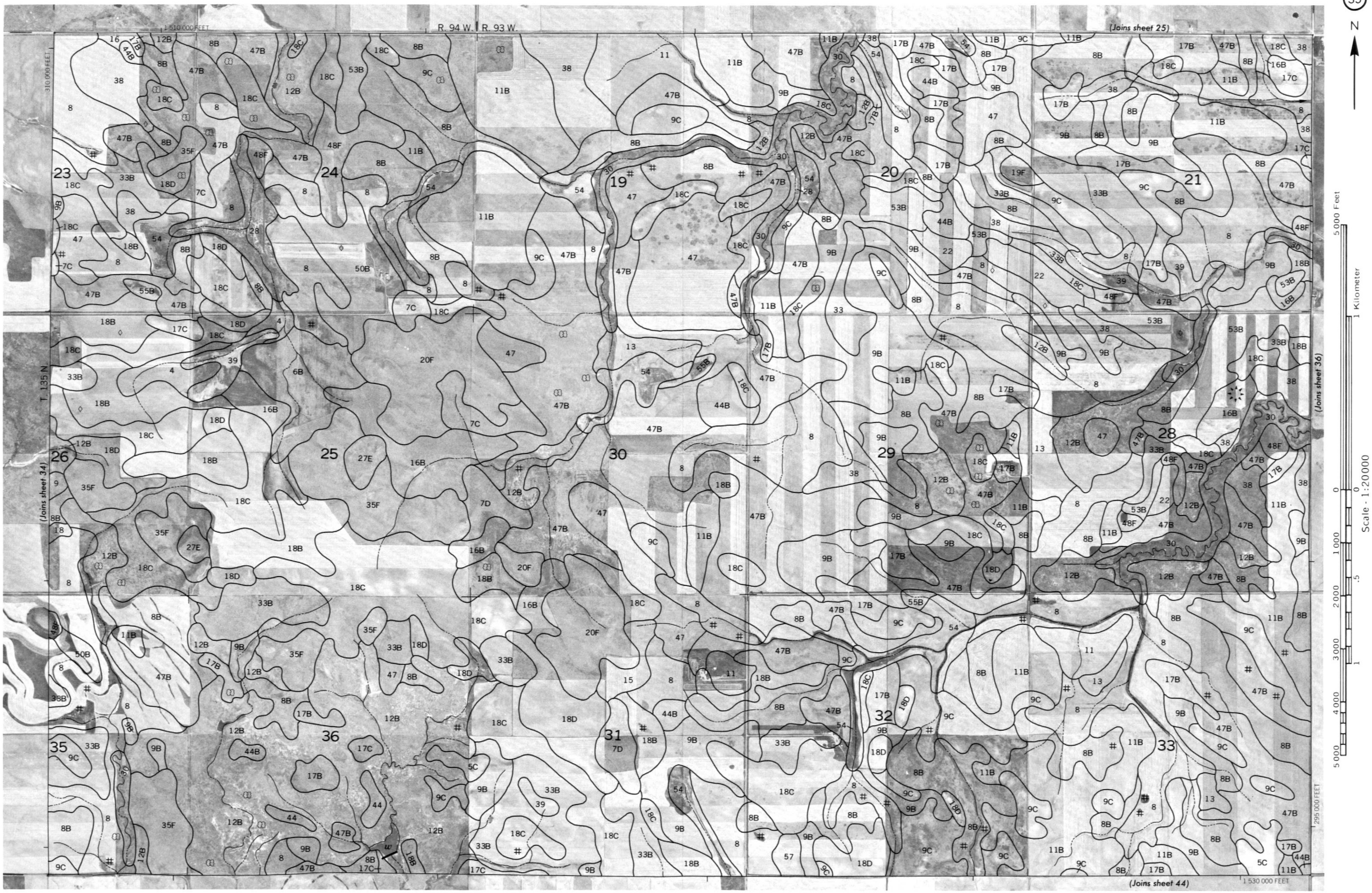


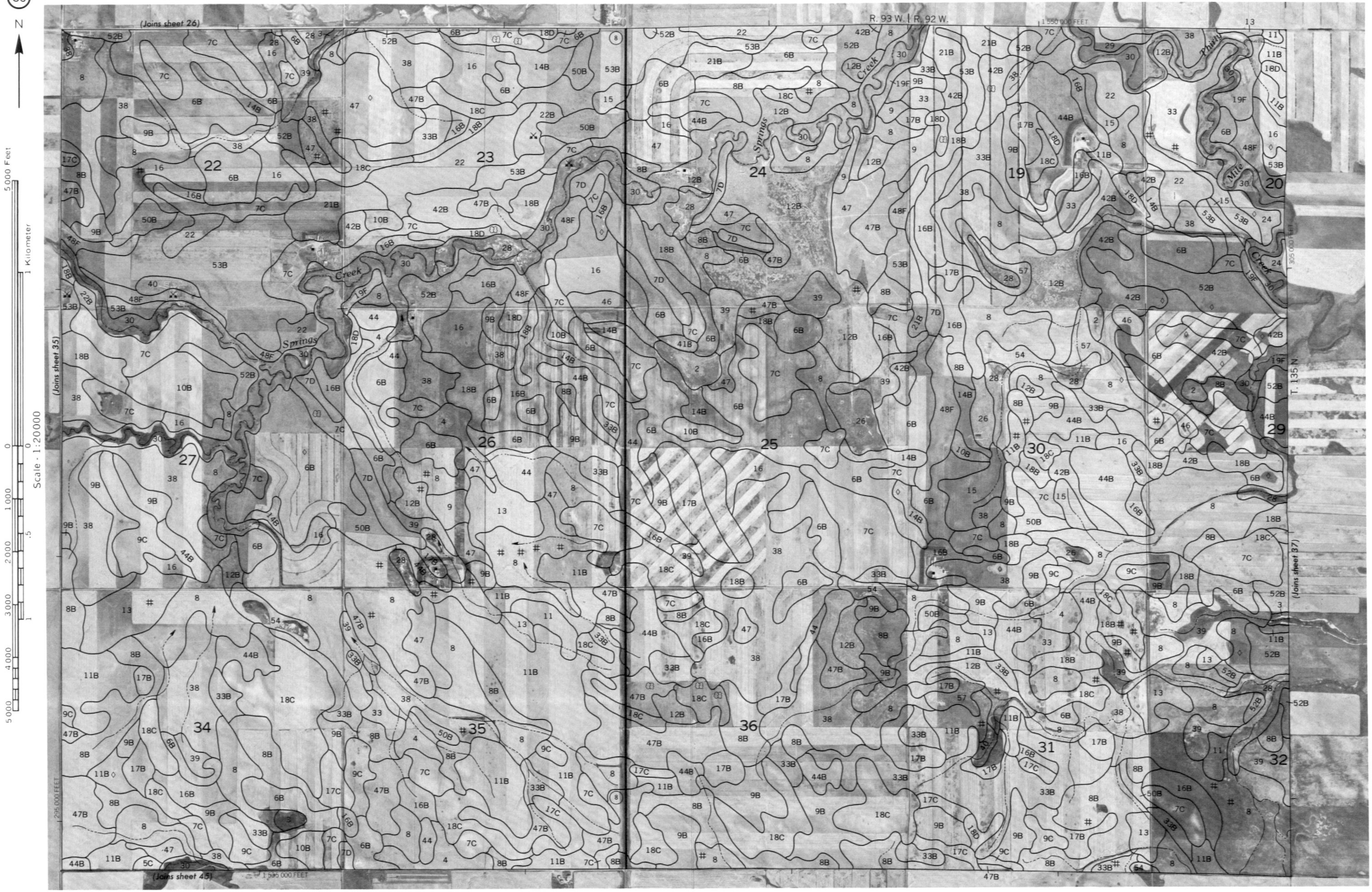
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1

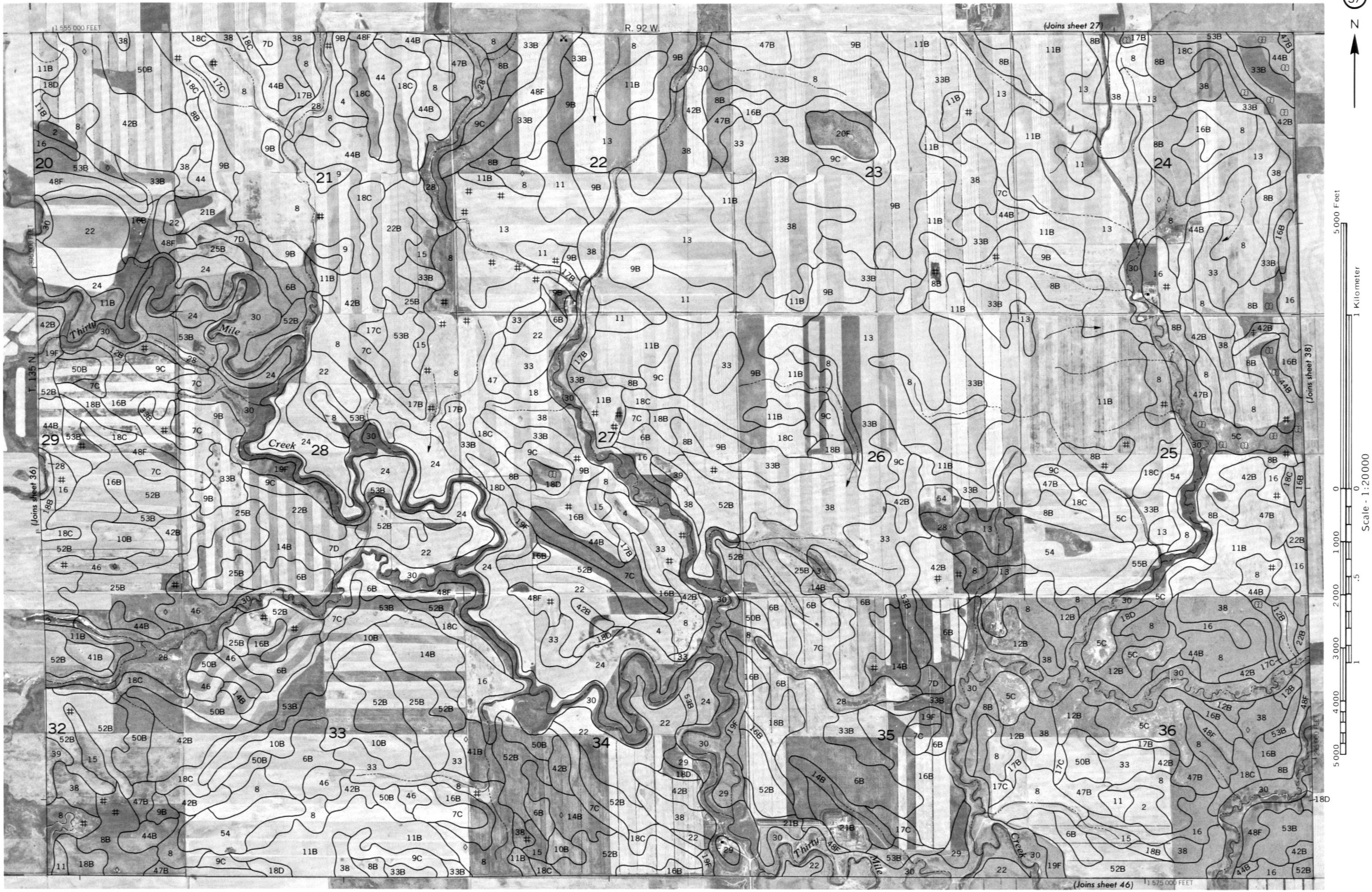

N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 22)
R. 96 W.
R. 95 W.
1 465 000 FEET
310 000 FEET
T. 135 N.
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 41)
1 440 000 FEET
300 000 FEET
CANNONBALL
RIVER
Hay
Slough
Creek
Coal
Bank
Creek
CANNONBALL
RIVER
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32


N
1 460 000 FEET
310 000 FEET
R. 95 W.
(Joins sheet 23)
T. 135 N.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 42)
1 480 000 FEET
290 000 FEET
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
5 000 Feet
1 Kilometer
Scale 1:20 000

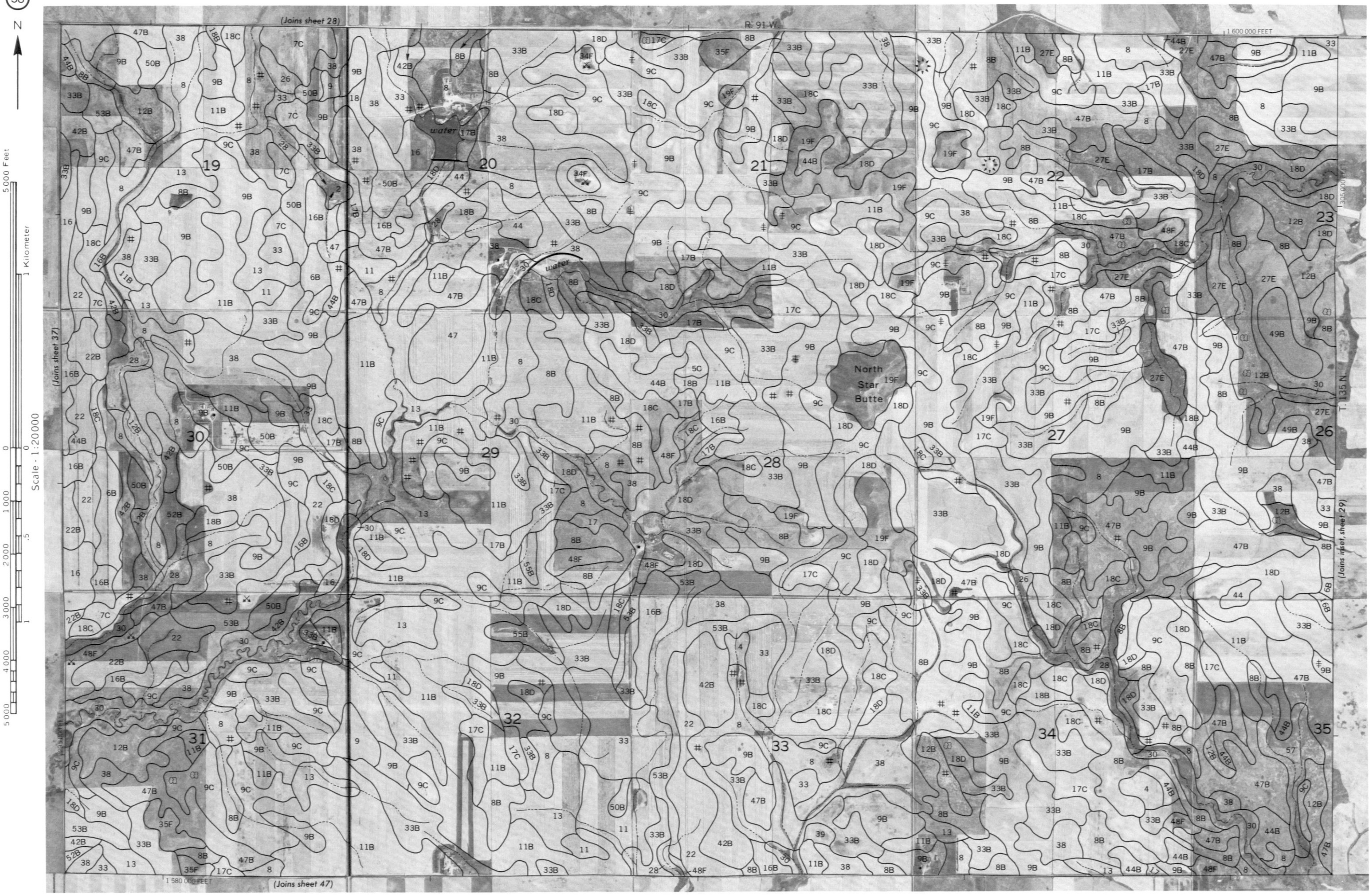

34
N
(Joins sheet 24)
R. 94 W.
1 505 000 FEET
310 000 FEET
T. 135 N.
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 43)
1 485 000 FEET
Spring Creek
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1 000
2 000
3 000
4 000
5 000
0
.5
1

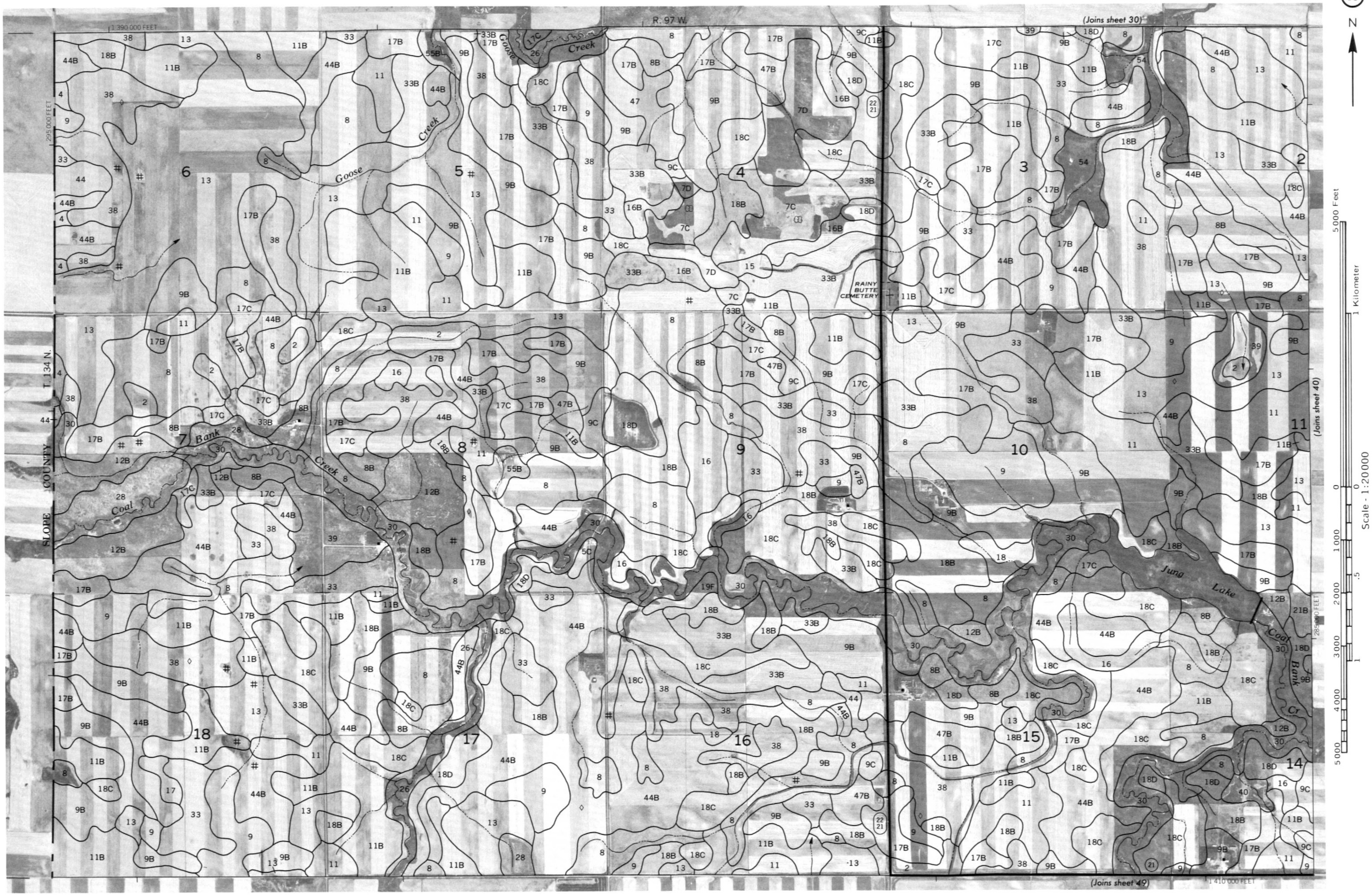

(Joins sheet 25)
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 34)
R. 94 W.
R. 93 W.
T. 135 N.
1 510 000 FEET
310 000 FEET
295 000 FEET
1 530 000 FEET
N
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36


N
Scale - 1:20000
5000 Feet
1 Kilometer
(Joins sheet 26)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 45)
R. 93 W. | R. 92 W.
T. 135 N.
1 550 000 FEET
1 535 000 FEET
295 000 FEET
305 000 FEET
Springs Creek
Plum Mile Creek
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36

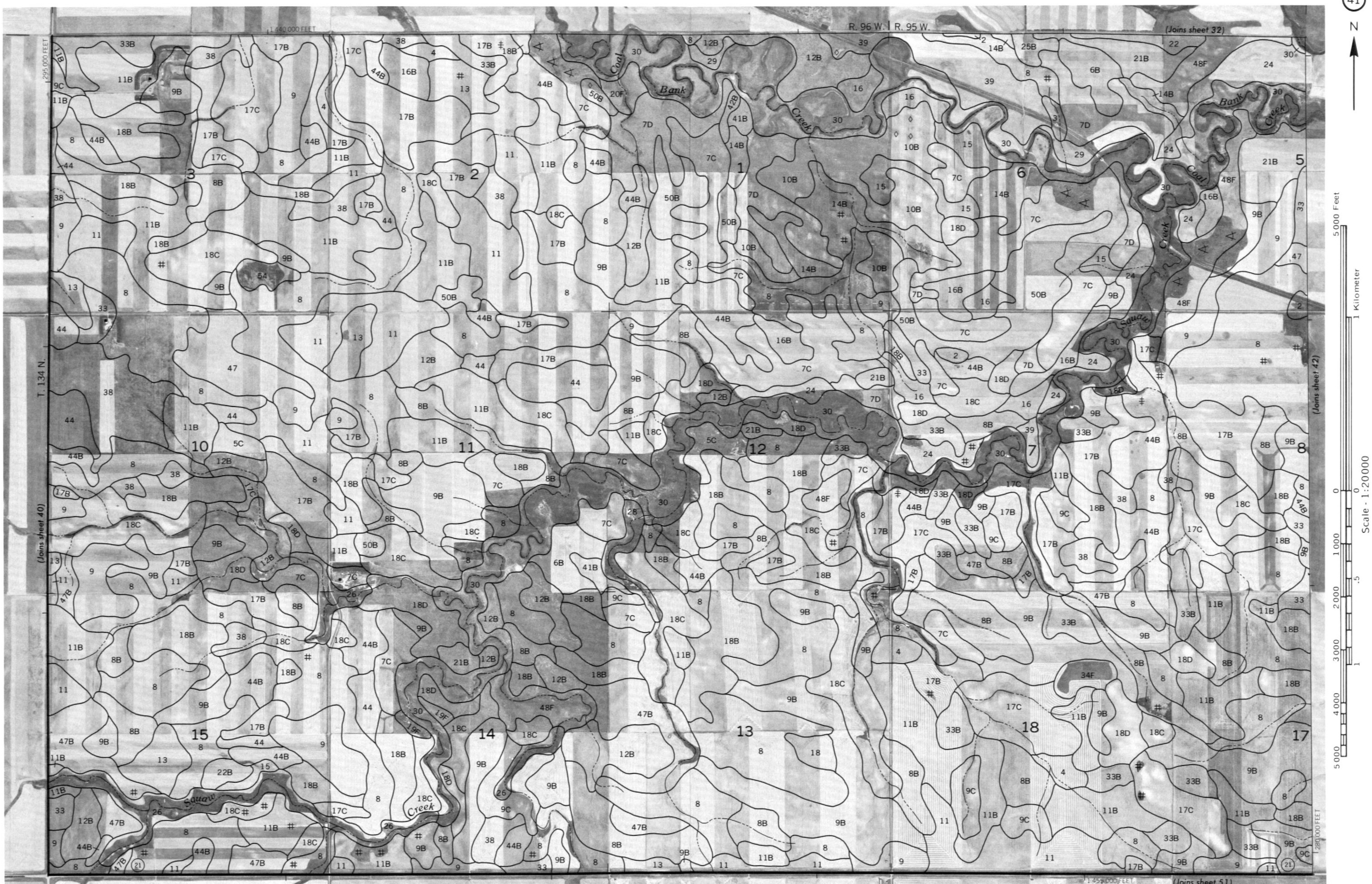

37
N
(Joins sheet 27)
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 36)
R. 92 W.
T. 135 N.
1 555 000 FEET
1 575 000 FEET
Thirty Mile Creek
5 000 Feet
1 Kilometer
Scale - 1:20000
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 38




N
R. 97 W.
(Joins sheet 30)
(Joins sheet 40)
(Joins sheet 49)
T. 134 N.
SLOPE COUNTY
1 390 000 FEET
295 000 FEET
1 410 000 FEET
Goose Creek
Coal Bank Creek
Jung Lake
RAINY BUTTE CEMETERY
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 31)
R. 97 W.
R. 96 W.
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 50)
T. 134 N.
1 435 000 FEET
1 415 000 FEET
295 000 FEET
Coal
Bank
Creek
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18


N
(Joins sheet 32)
(Joins sheet 42)
(Joins sheet 51)
(Joins sheet 40)
R. 96 W. | R. 95 W.
T. 134 N.
1 440 000 FEET
295 000 FEET
1 455 000 FEET
280 000 FEET
Coal
Bank
Creek
Squaw
Creek
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
0
.5
1
1
2
3
4
5
6
7
8
10
11
12
13
14
15
17
18

N

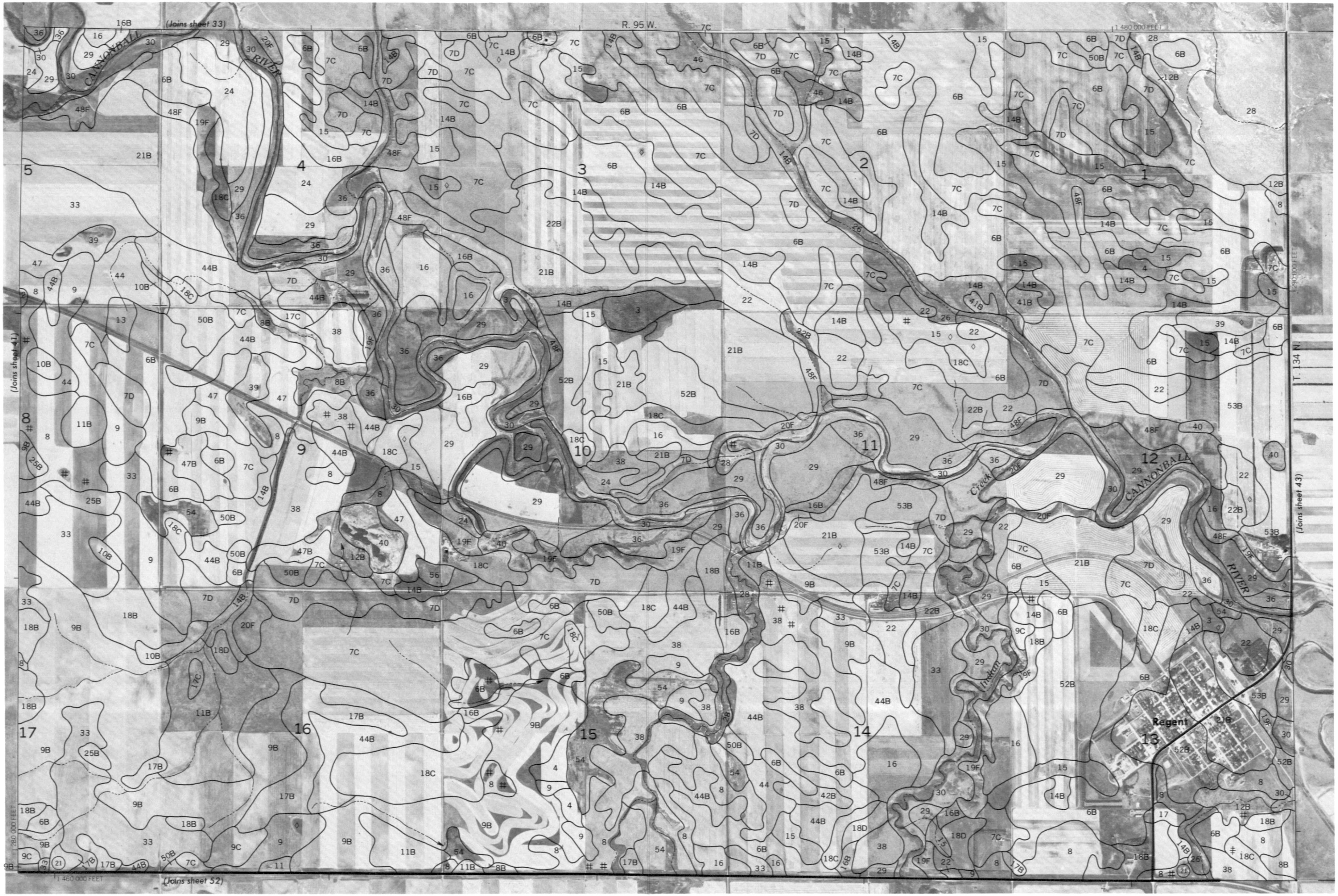
5 000 Feet

1 Kilometer

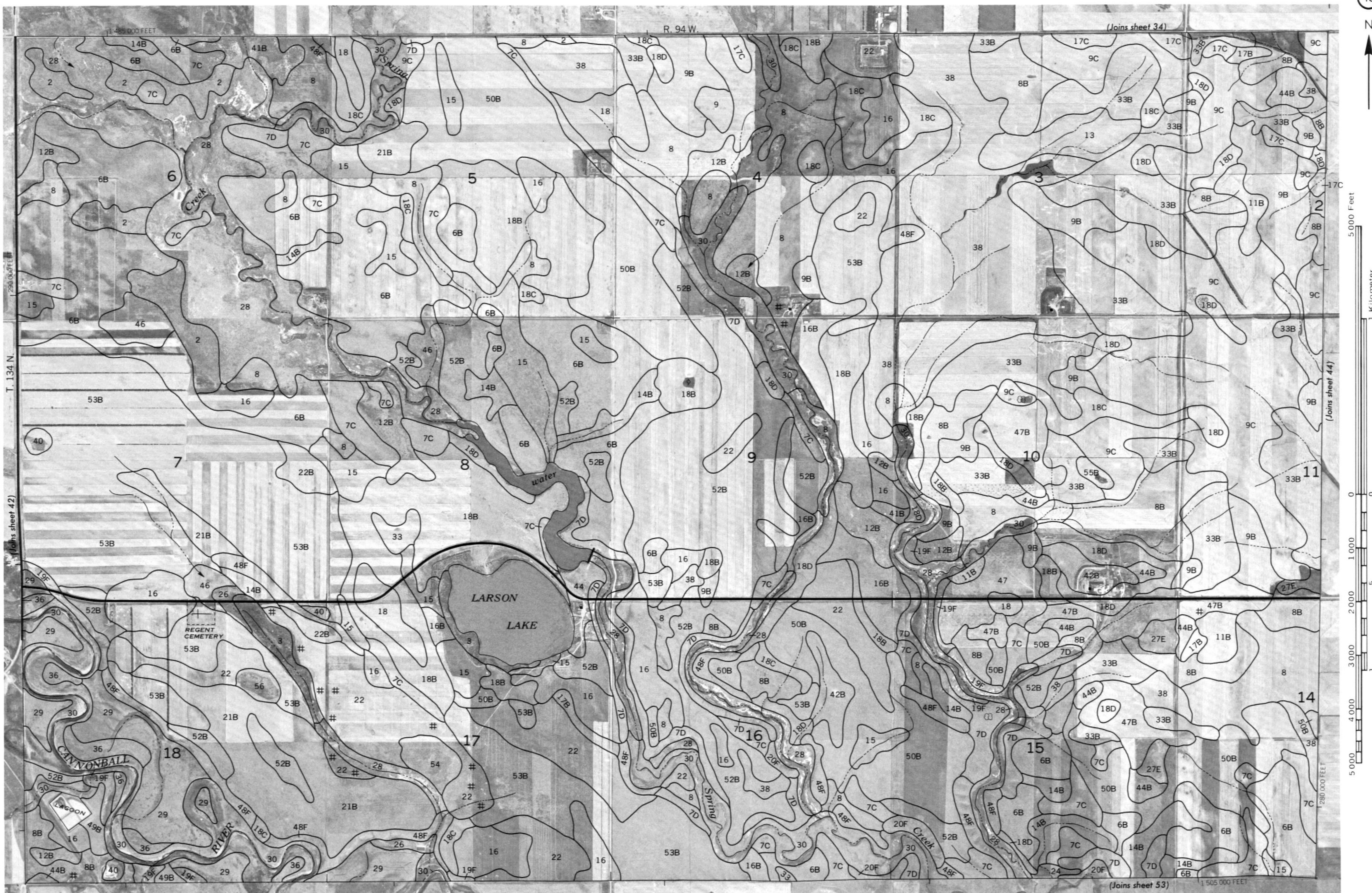
Scale 1:20000

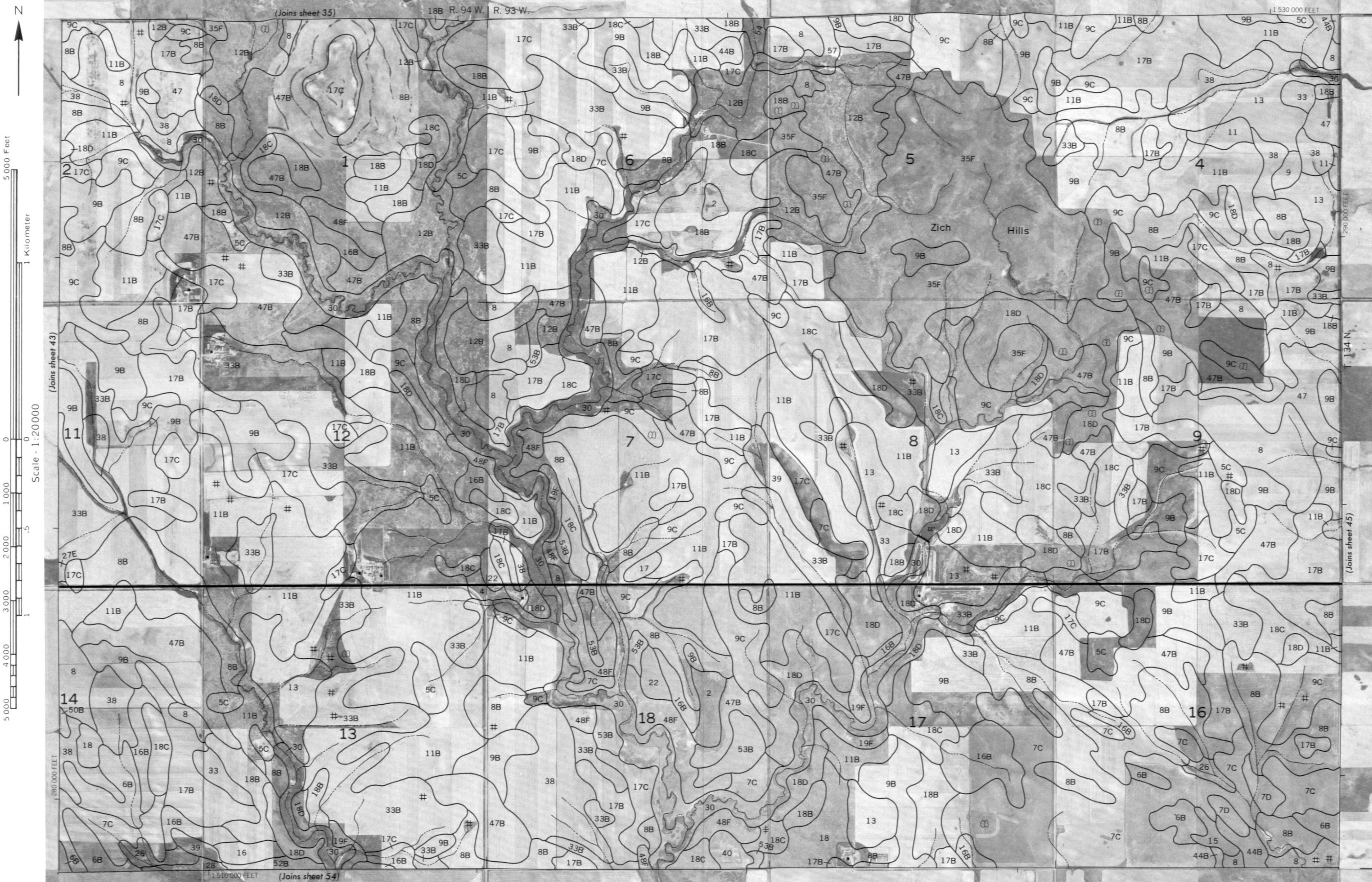
0 1000 2000 3000 4000 5000

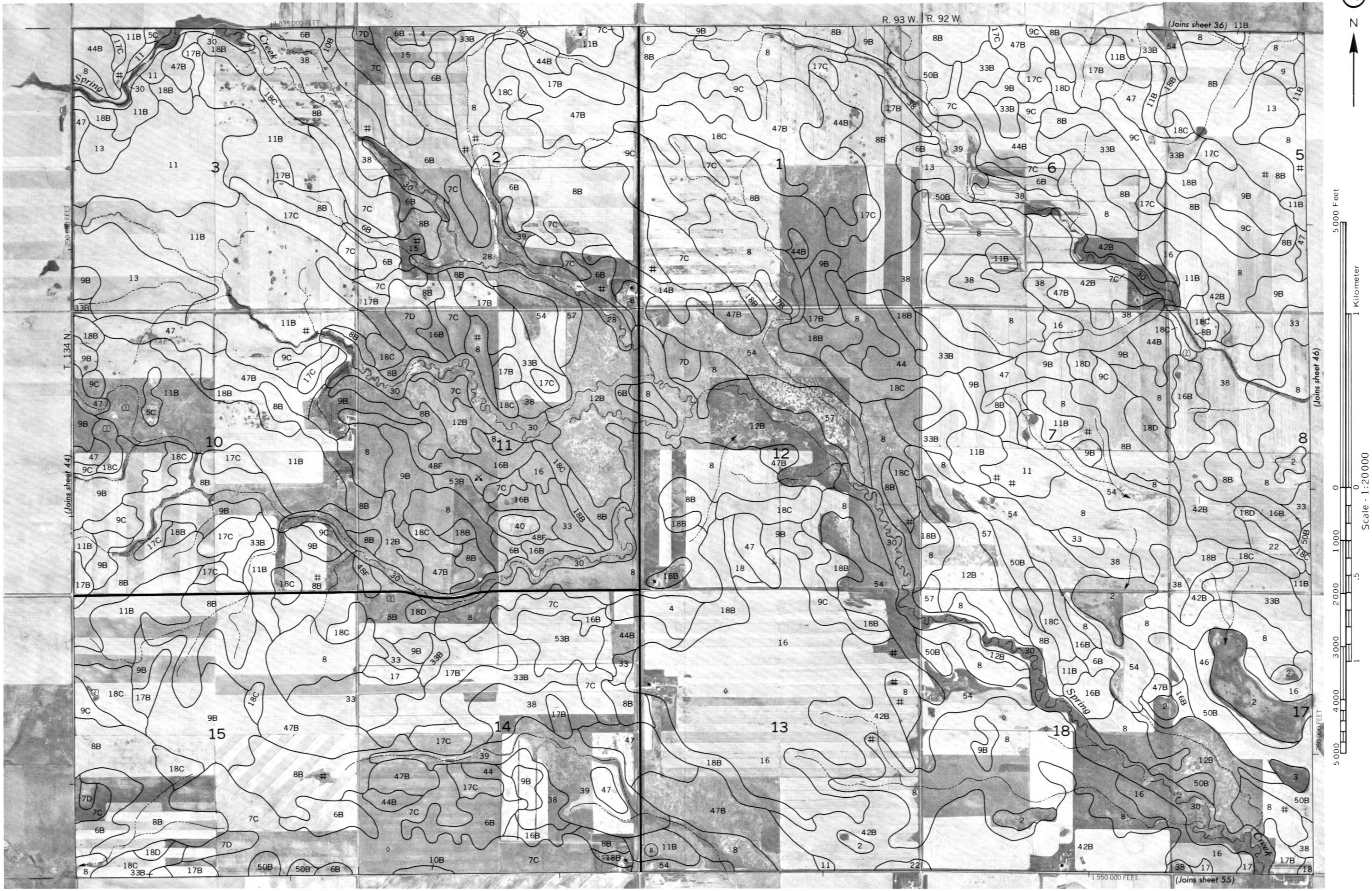
0 .5 1

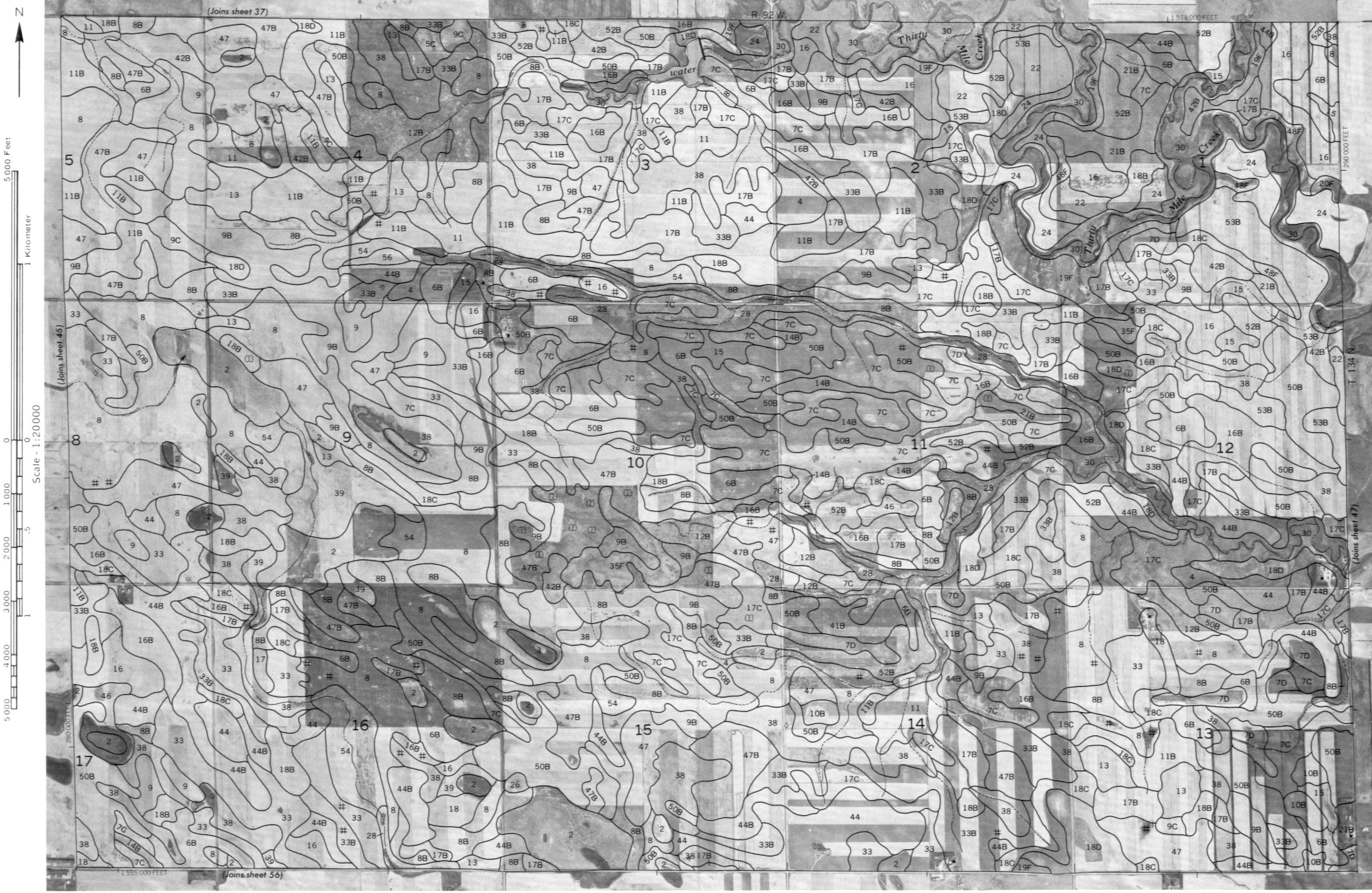


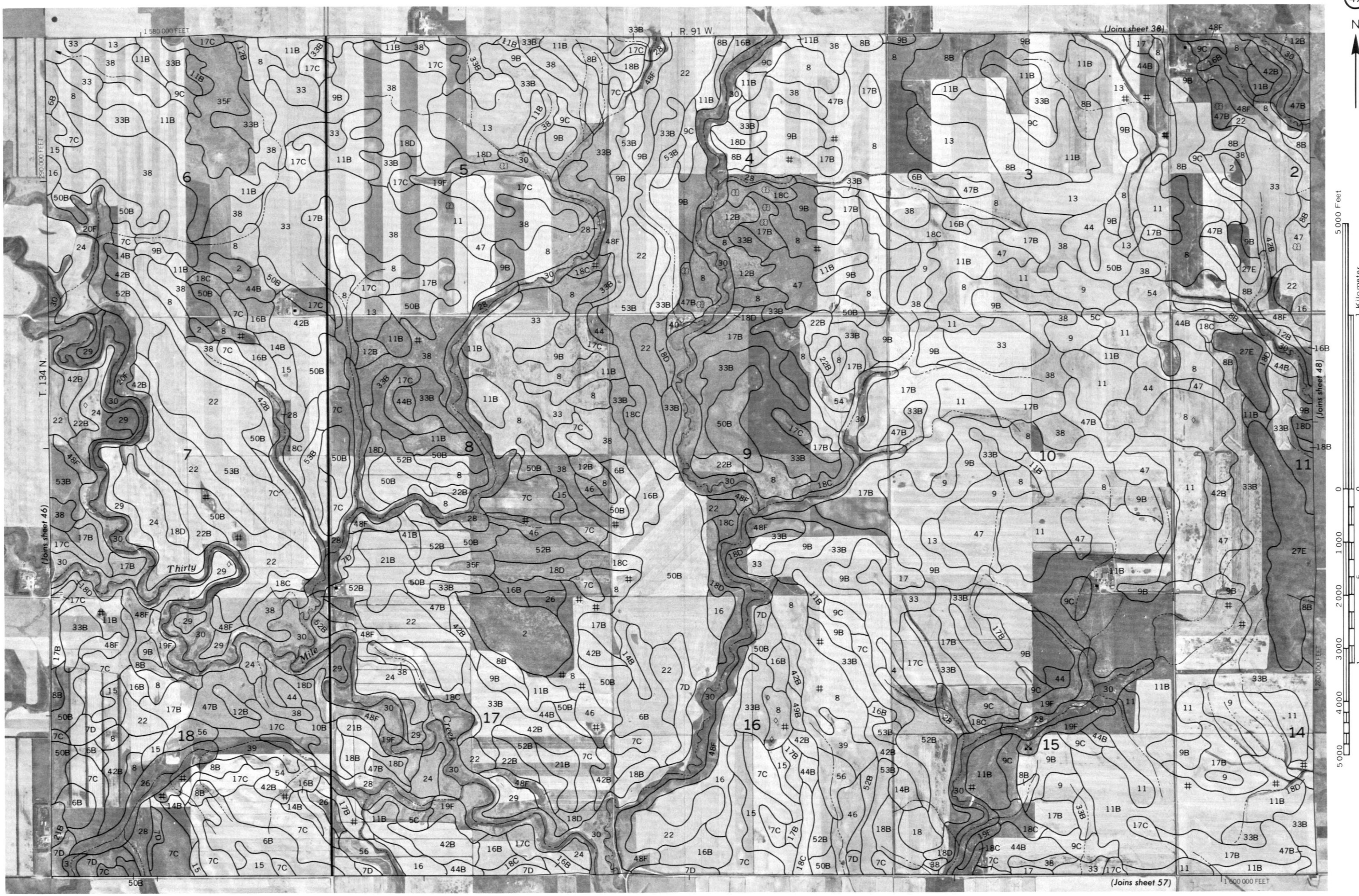
HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 43

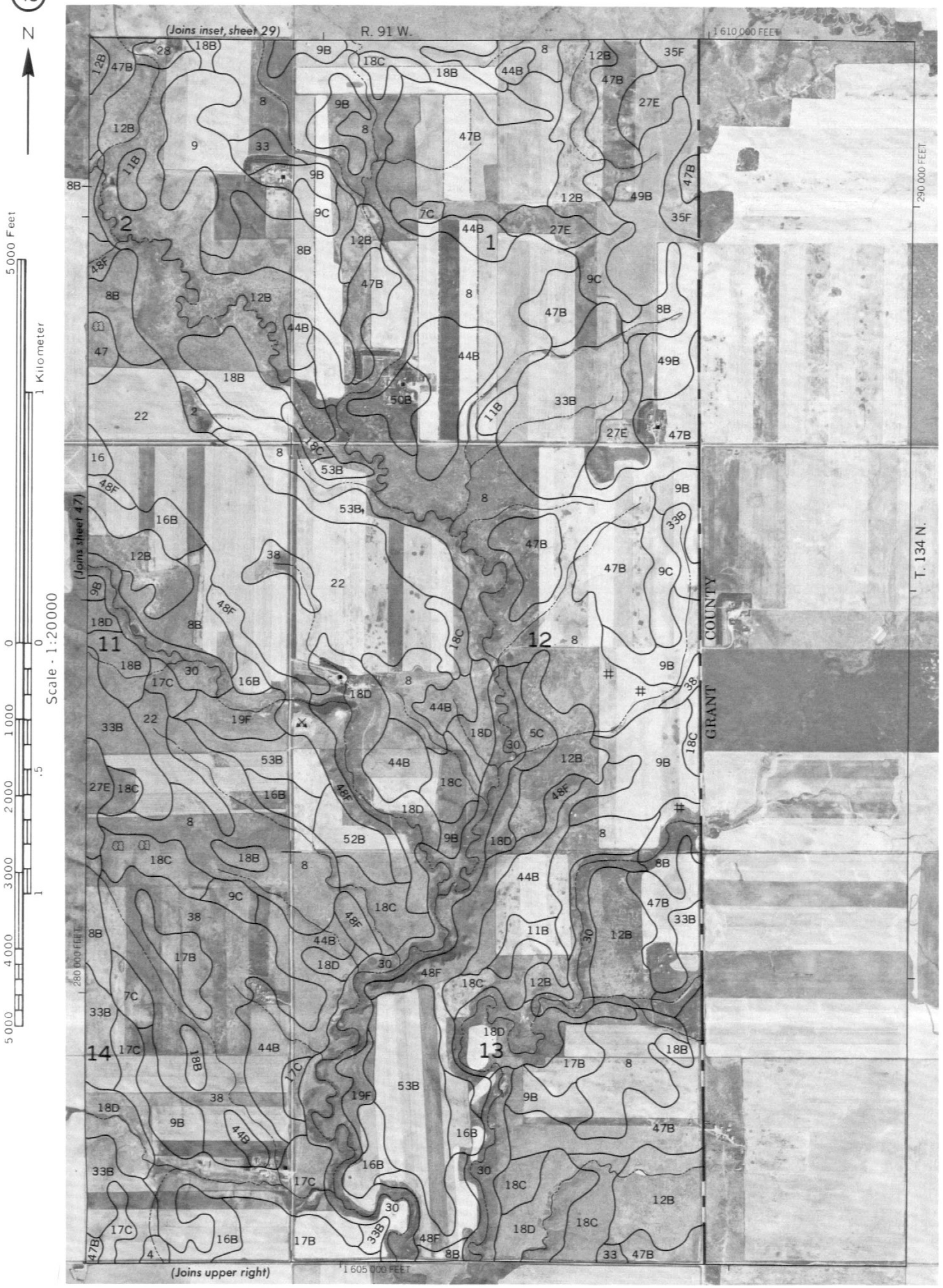



N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 35)
R. 94 W.
R. 93 W.
1 530 000 FEET
290 000 FEET
T. 134 N.
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 54)
280 000 FEET
1 510 000 FEET
Zich
Hills

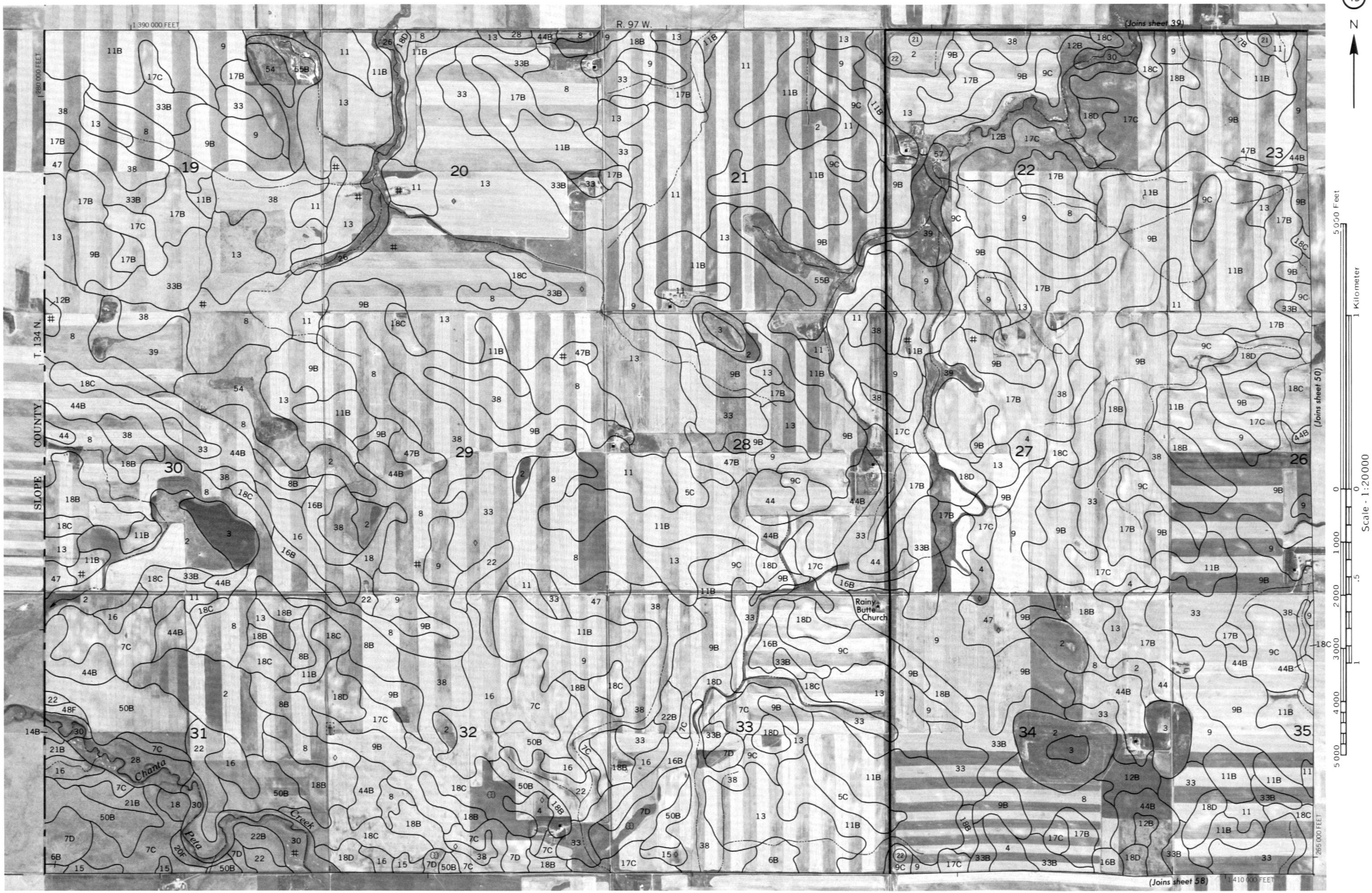

R. 93 W.
R. 92 W.
T. 134 N.
1 535 000 FEET
1 550 000 FEET
290 000 FEET
280 000 FEET
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 55)
Spring
Creek
N
5000 Feet
1 Kilometer
Scale - 1:20000

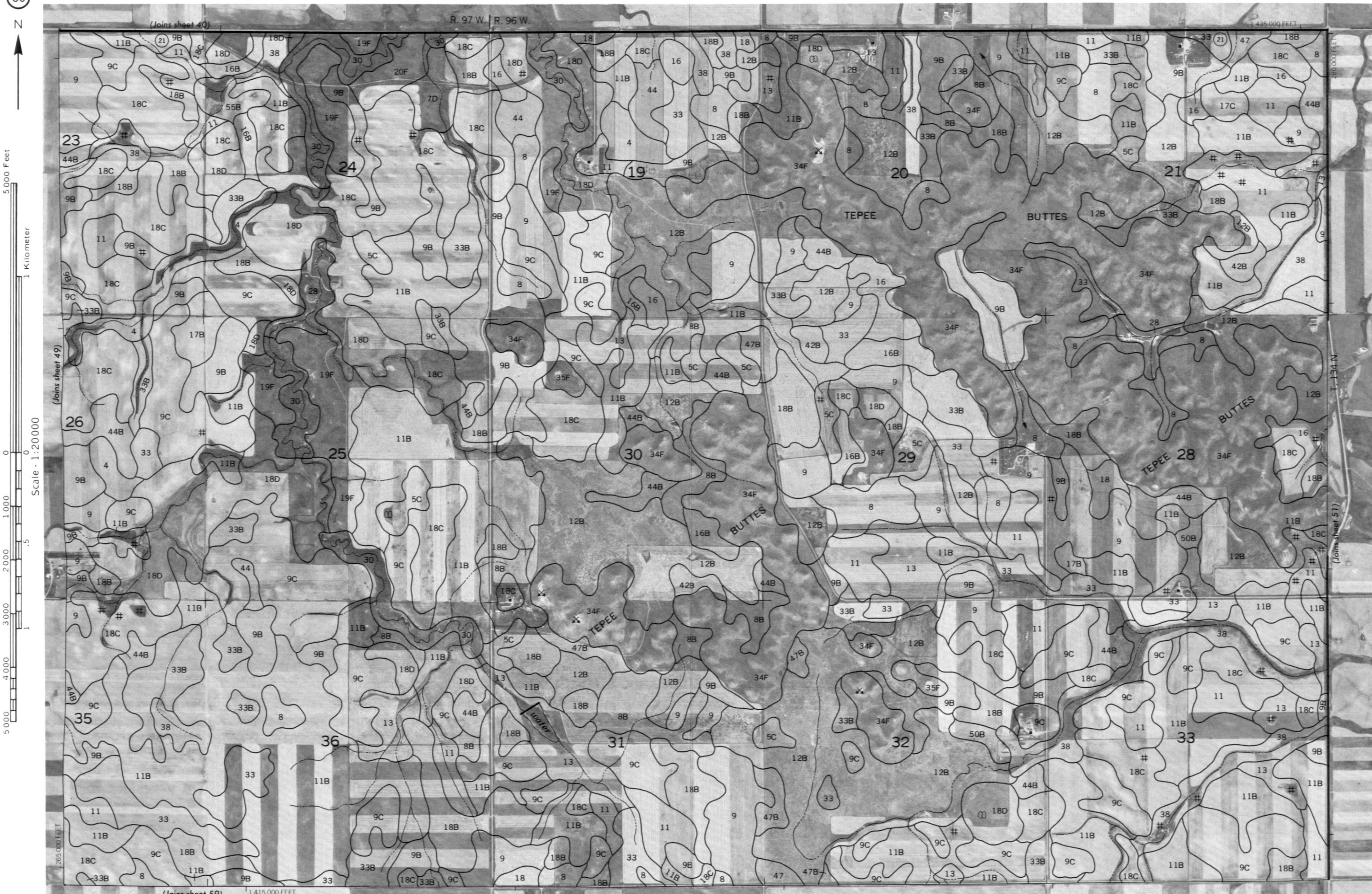

N
(Joins sheet 37)
R. 92 W.
Thirty Mile Creek
water
T. 134 N.
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 56)
1 575 000 FEET
1 555 000 FEET
290 000 FEET
280 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000

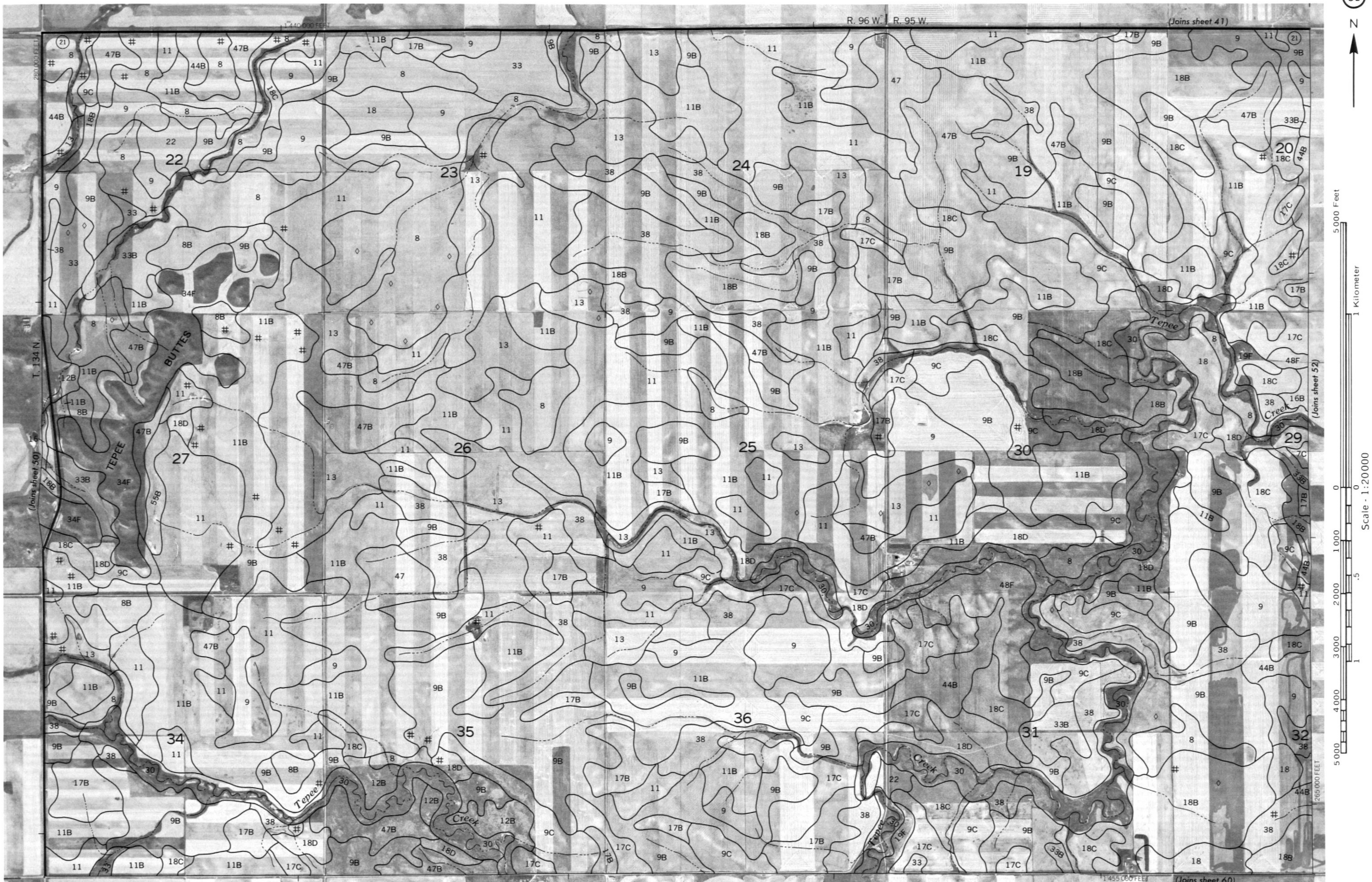

47
N
R. 91 W.
T. 134 N.
(Joins sheet 38)
(Joins sheet 48)
(Joins sheet 57)
(Joins sheet 46)
1 580 000 FEET
1 600 000 FEET
Thirty
Mile
Creek
5 000 Feet
1 Kilometer
Scale - 1:20000

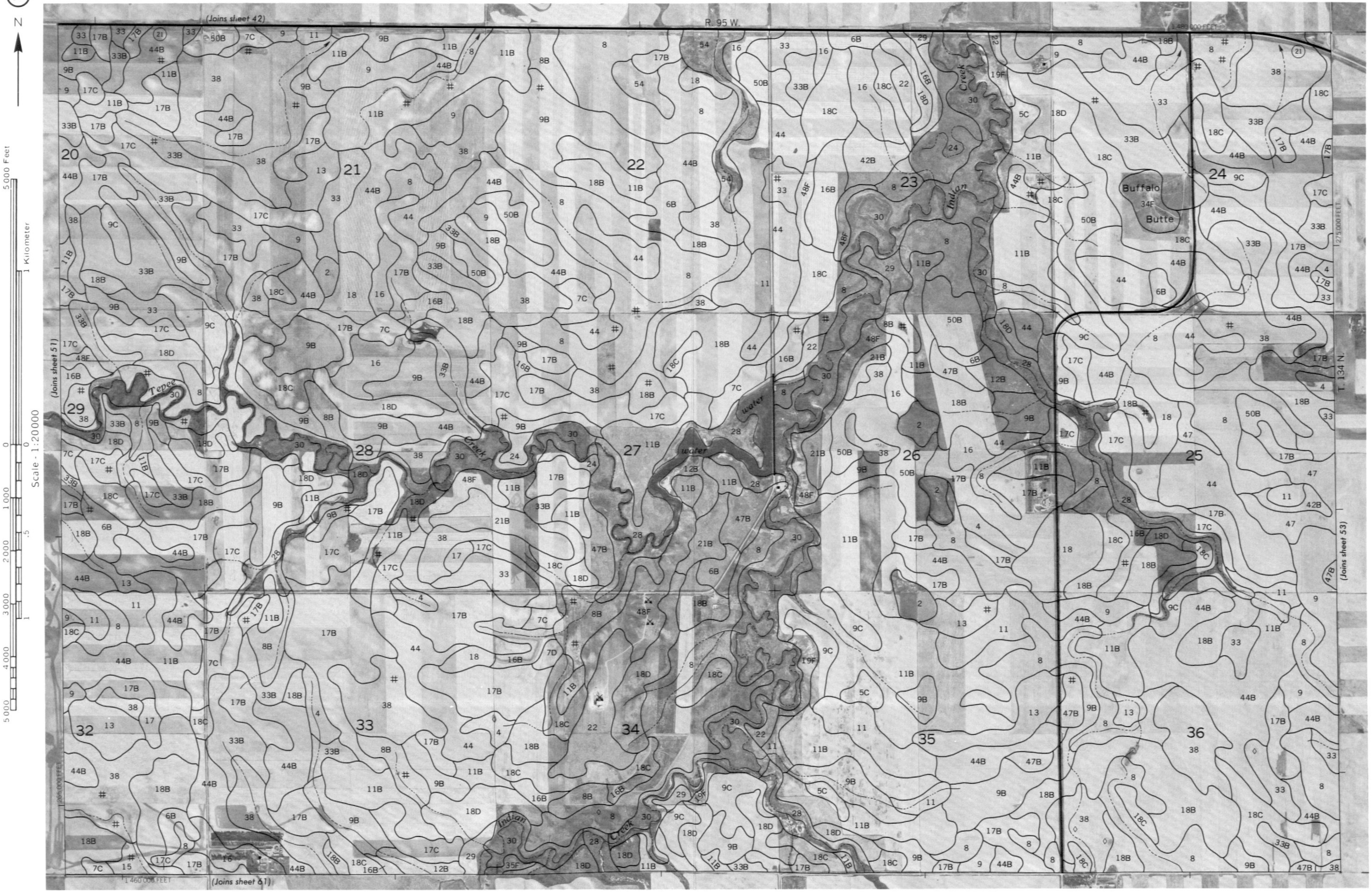

N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins inset, sheet 29)
R. 91 W.
1 610 000 FEET
290 000 FEET
T. 134 N.
GRANT COUNTY
(Joins sheet 47)
280 000 FEET
(Joins upper right)
1 605 000 FEET

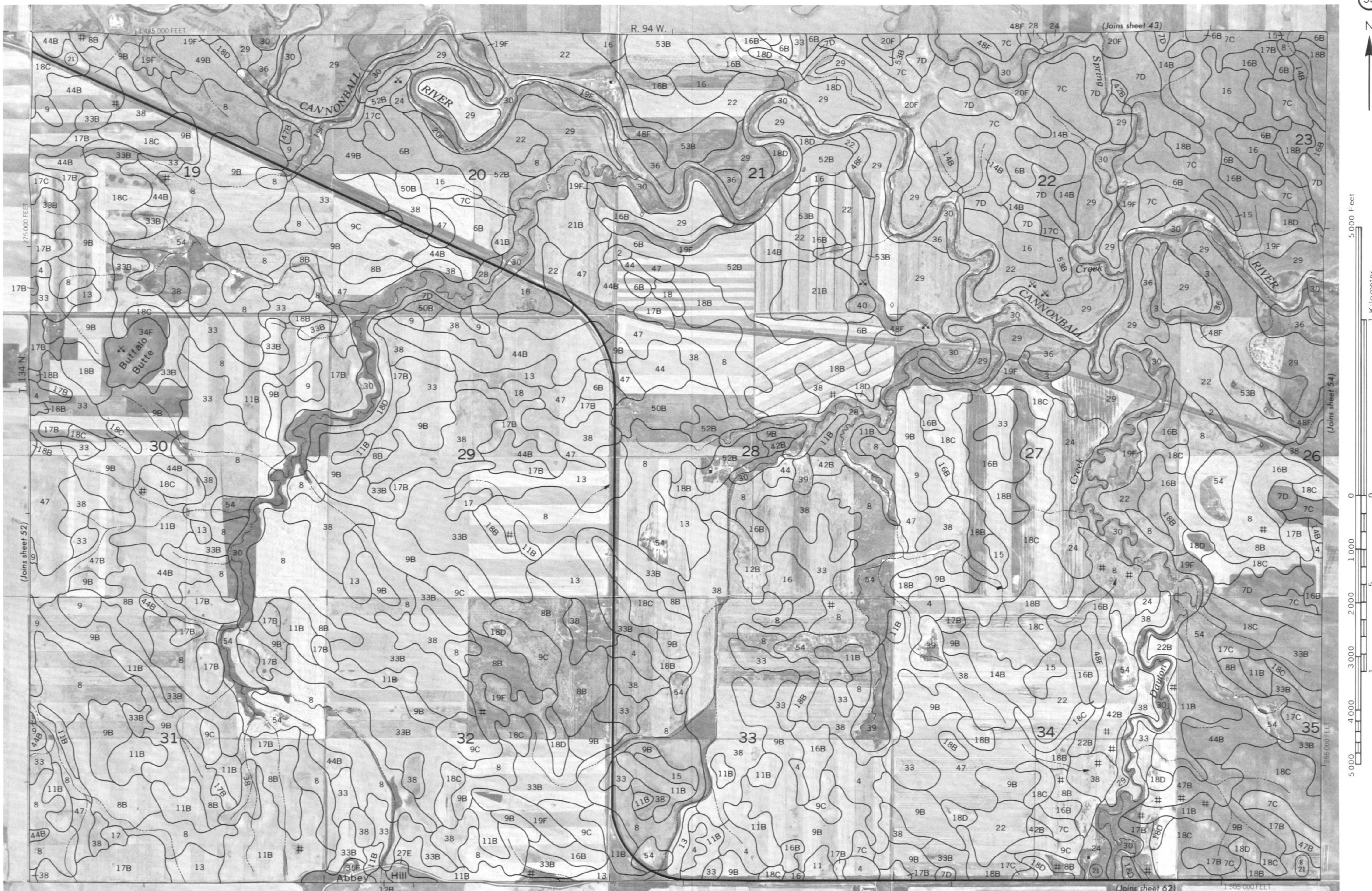

(Joins lower left)
R. 91 W.
1 610 000 FEET
T. 134 N.
GRANT COUNTY
(Joins sheet 57)
Thirty
Mile
Creek
265 000 FEET
(Joins sheet 67)
1 605 000 FEET


49
N
R. 97 W.
T. 134 N.
SLOPE COUNTY
(Joins sheet 39)
(Joins sheet 50)
(Joins sheet 58)
1 390 000 FEET
1 410 000 FEET
280 000 FEET
265 000 FEET
Rainy Butte Church
Chanta Peta Creek
5000 Feet
1 Kilometer
Scale - 1:20000

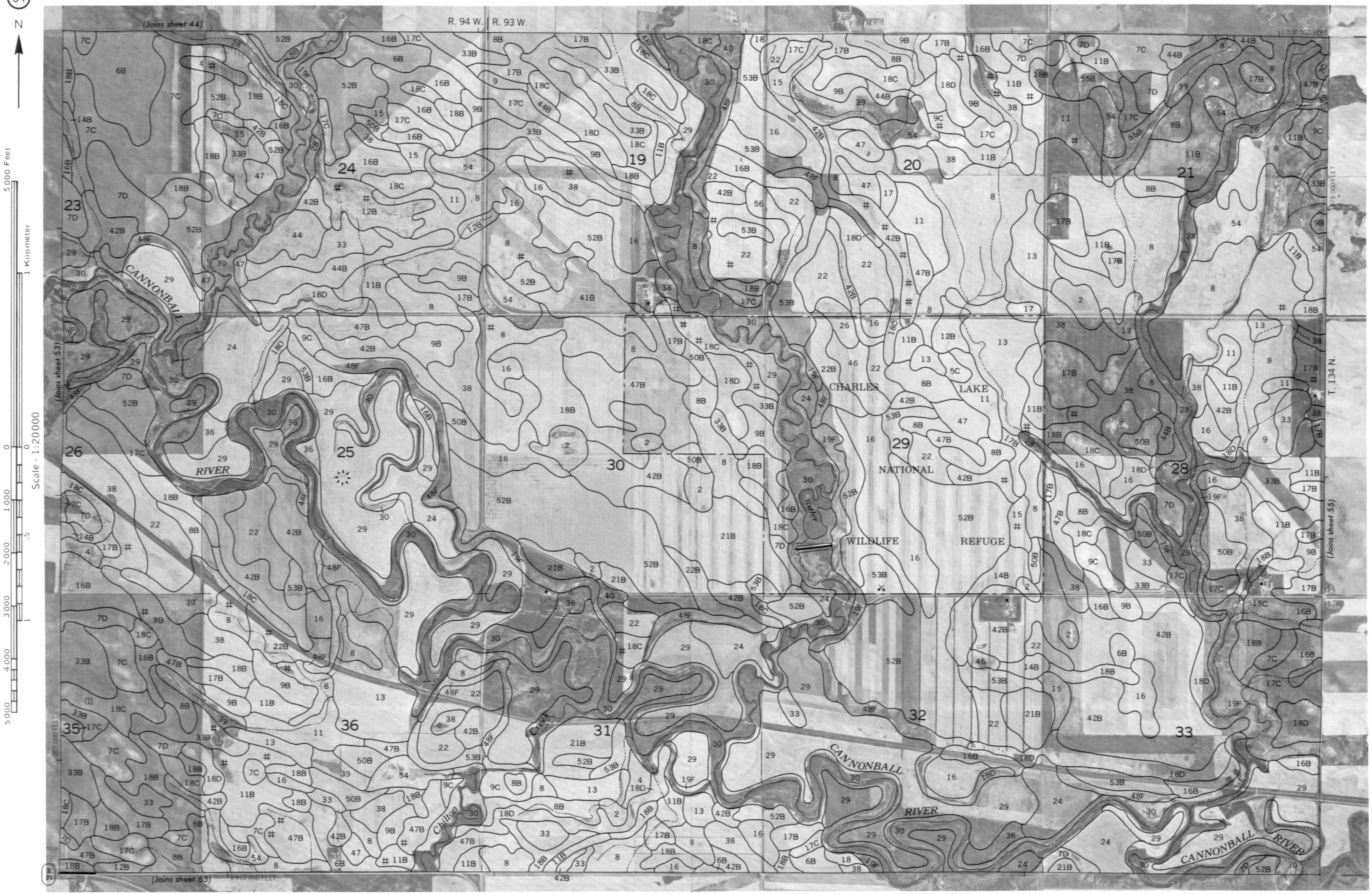

N
(Joins sheet 40)
R. 97 W. | R. 96 W.
1 435 000 FEET
TEPEE
BUTTES
TEPEE
BUTTES
TEPEE
BUTTES
TEPEE
T. 134 N.
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 59)
1 415 000 FEET
265 000 FEET
water
5000 Feet
1 Kilometer
Scale 1:20 000
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

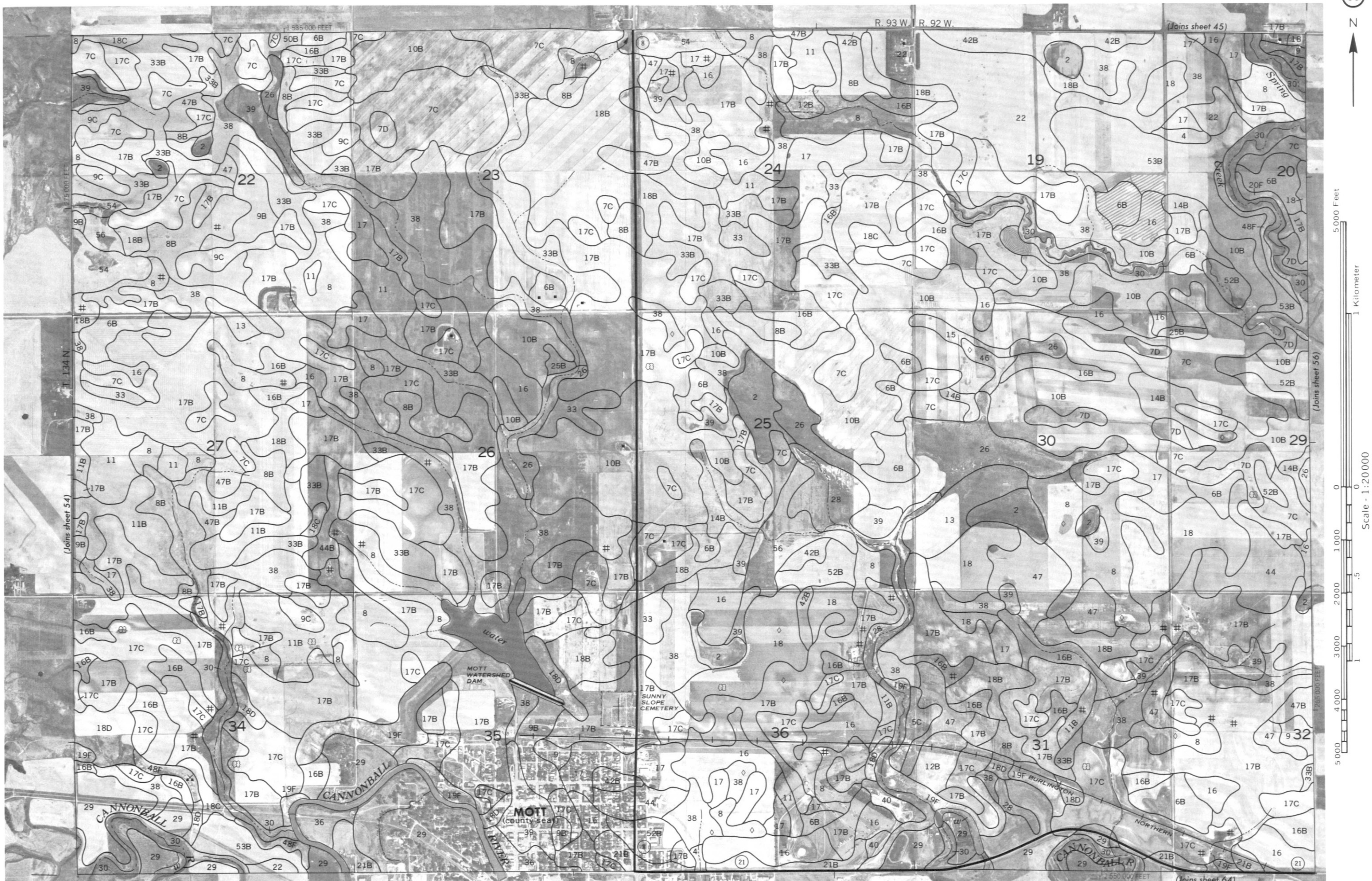

51
N
(Joins sheet 41)
R. 96 W.
R. 95 W.
T. 134 N.
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 60)
1 440 000 FEET
1 455 000 FEET
280 000 FEET
265 000 FEET
TEPEE
BUTTES
Tepee
Creek
5000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 42)
R. 95 W.
T. 134 N.
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 61)
1 460 000 FEET
Tepee
Creek
Indian
Creek
Buffalo
Butte
water
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

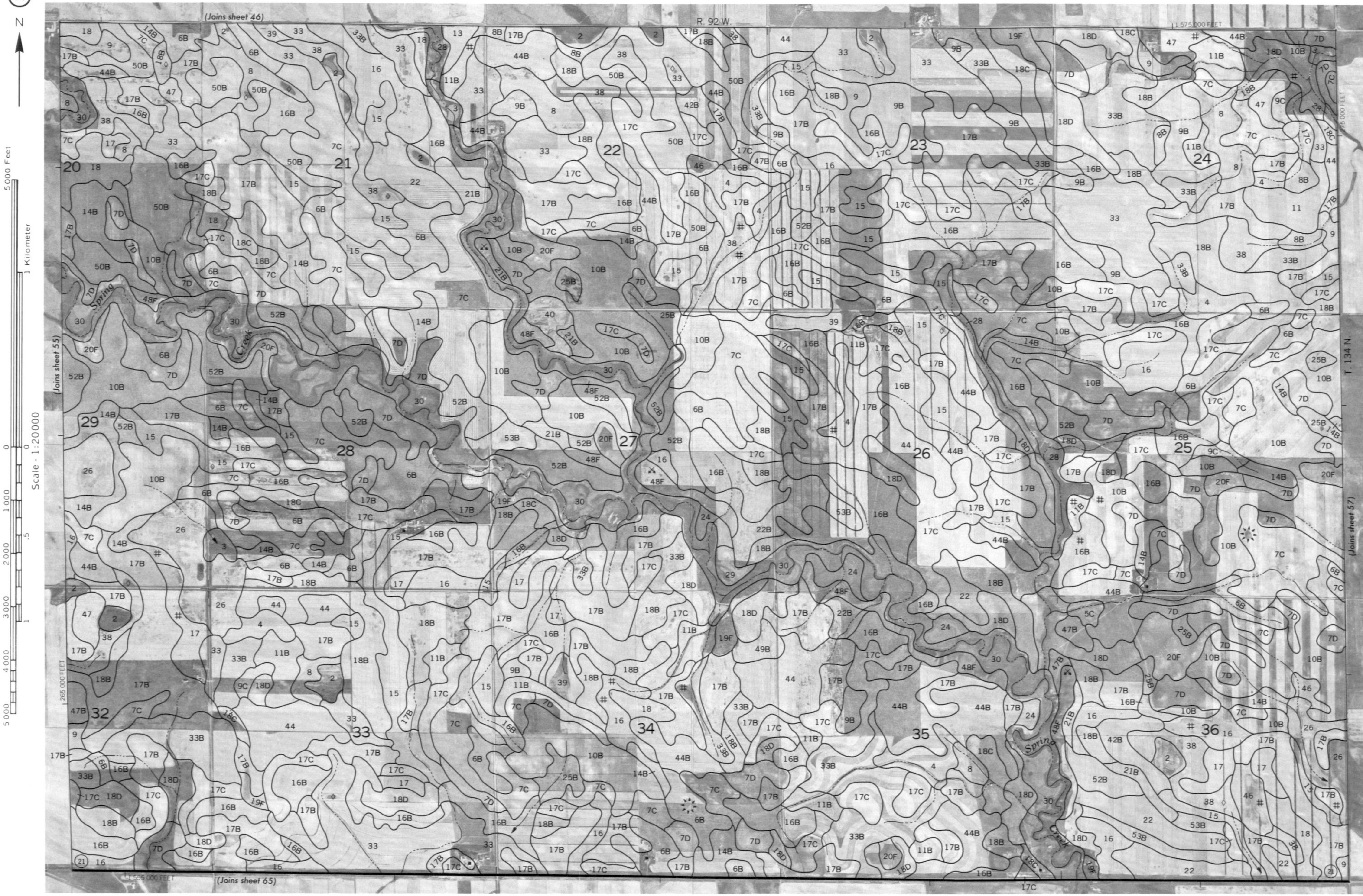


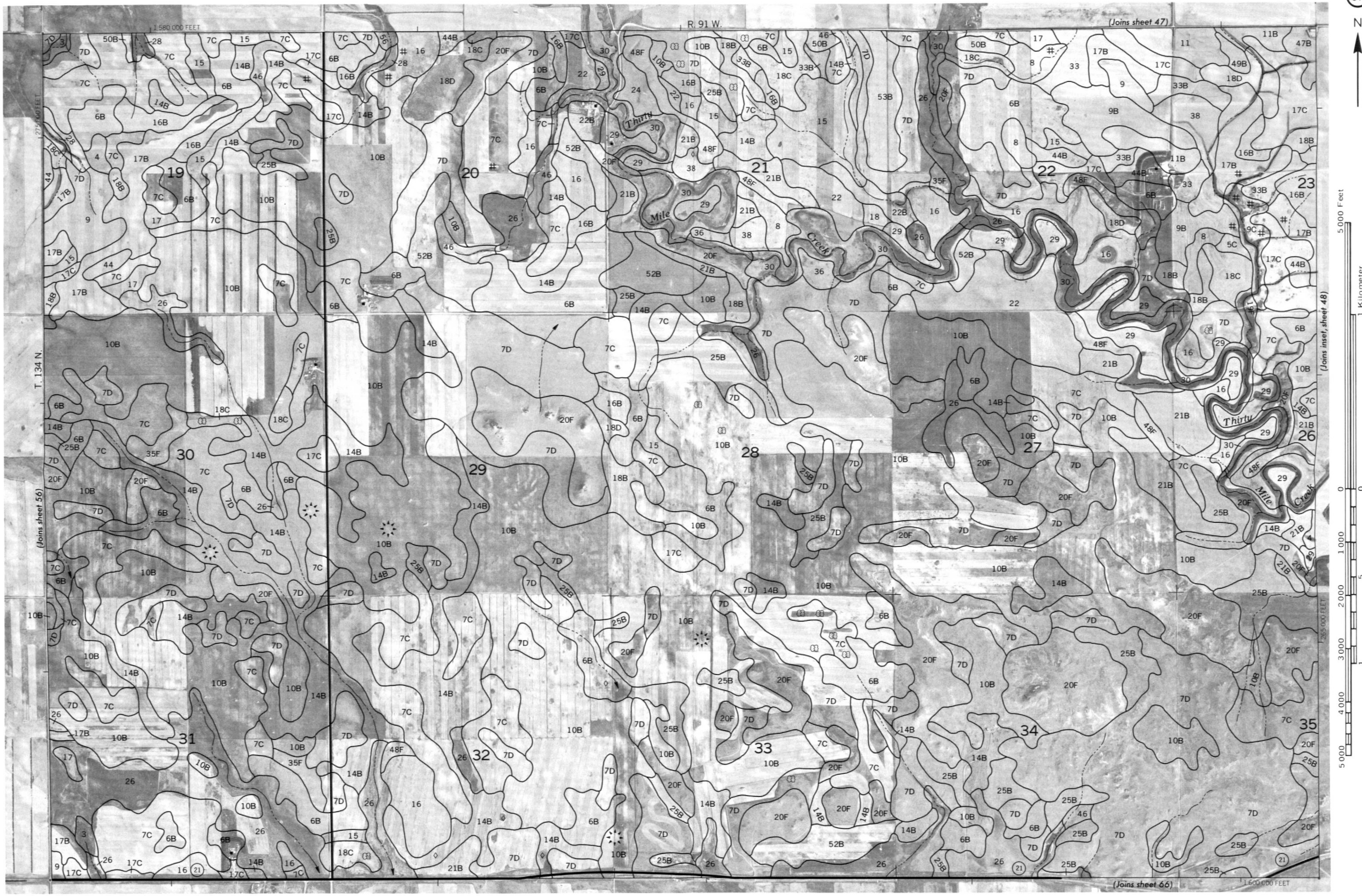
53
N
R. 94 W.
T. 134 N.
(Joins sheet 43)
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 62)
CANNONBALL
RIVER
Spring
Creek
Buffalo Butte
Abbey
Hill
1 485 000 FEET
1 505 000 FEET
275 000 FEET
286 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 44)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 63)
R. 94 W. | R. 93 W.
T. 134 N.
CANNONBALL
RIVER
CHARLES
LAKE
NATIONAL
WILDLIFE
REFUGE
Creek
Chilton
Water
CANNONBALL
RIVER
CANNONBALL
RIVER
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

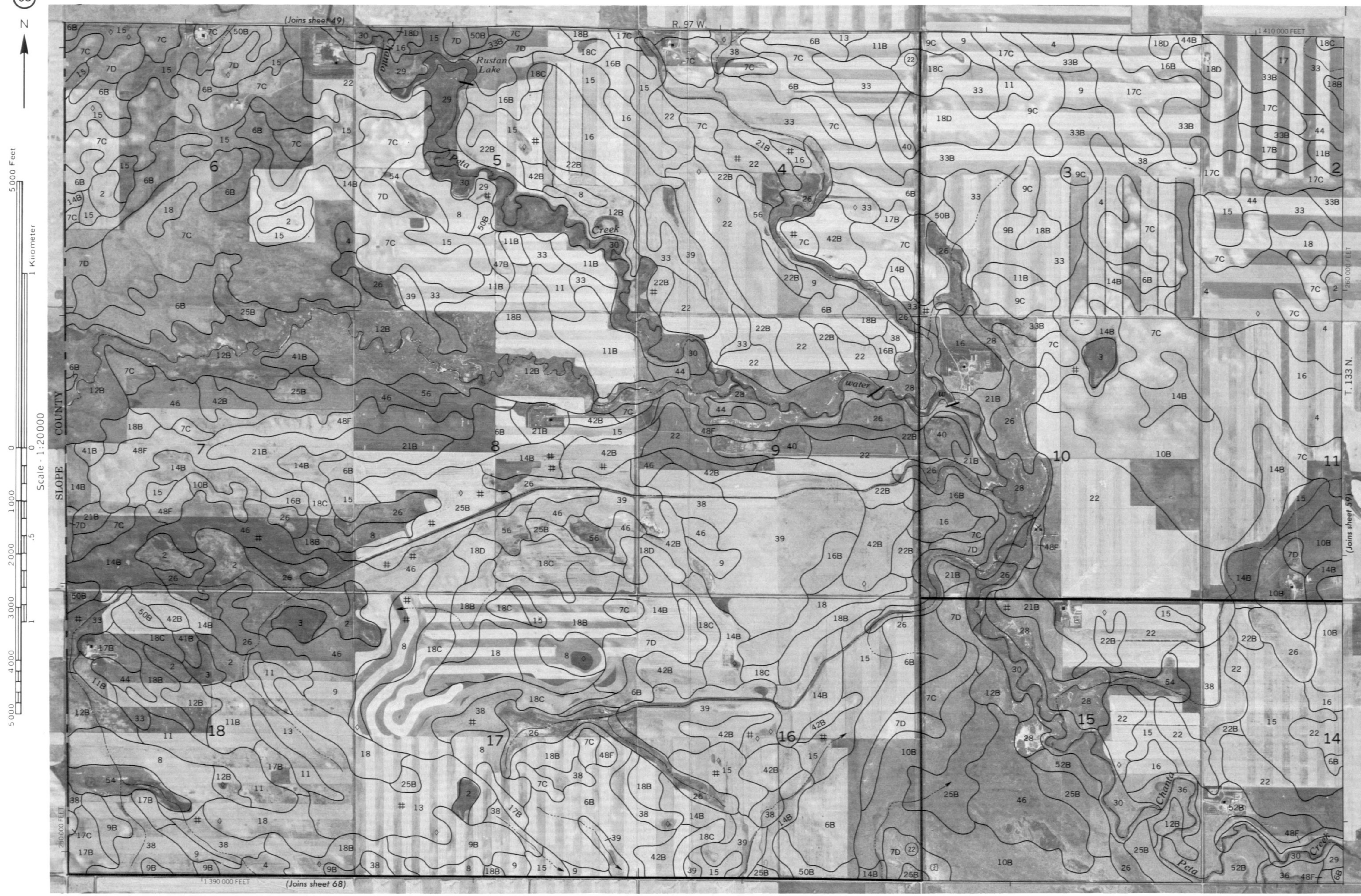


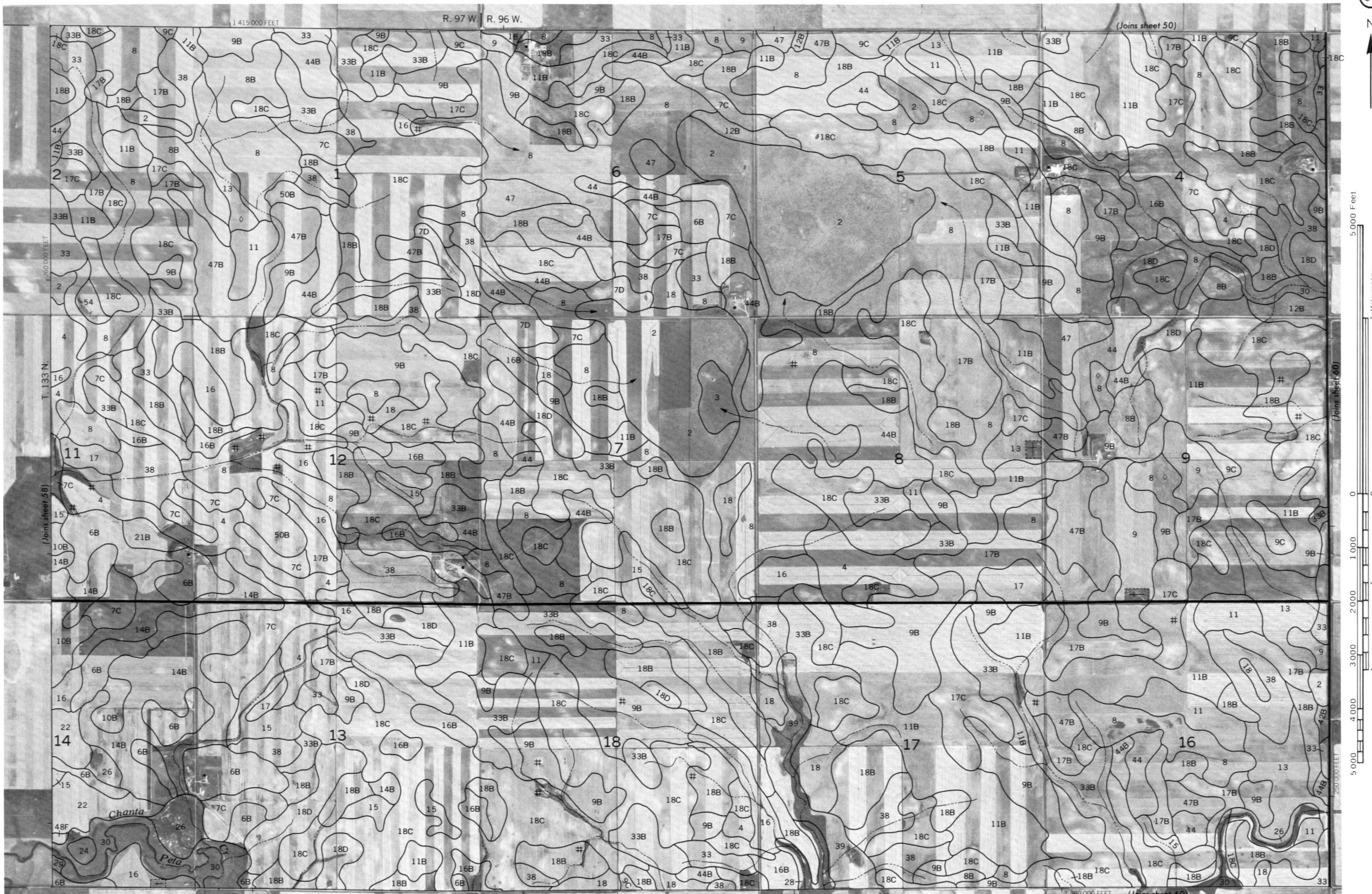
(Joins sheet 45)
(Joins sheet 56)
(Joins sheet 64)
(Joins sheet 54)
R. 93 W. | R. 92 W.
T. 134 N.
1 585 000 FEET
175 000 FEET
160 000 FEET
1 650 000 FEET
N
Spring Creek
MOTT WATERSHED DAM
water
SUNNY SLOPE CEMETERY
MOTT (county seat)
CANNONBALL RIVER
CANNONBALL R.
BURLINGTON NORTHERN
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1

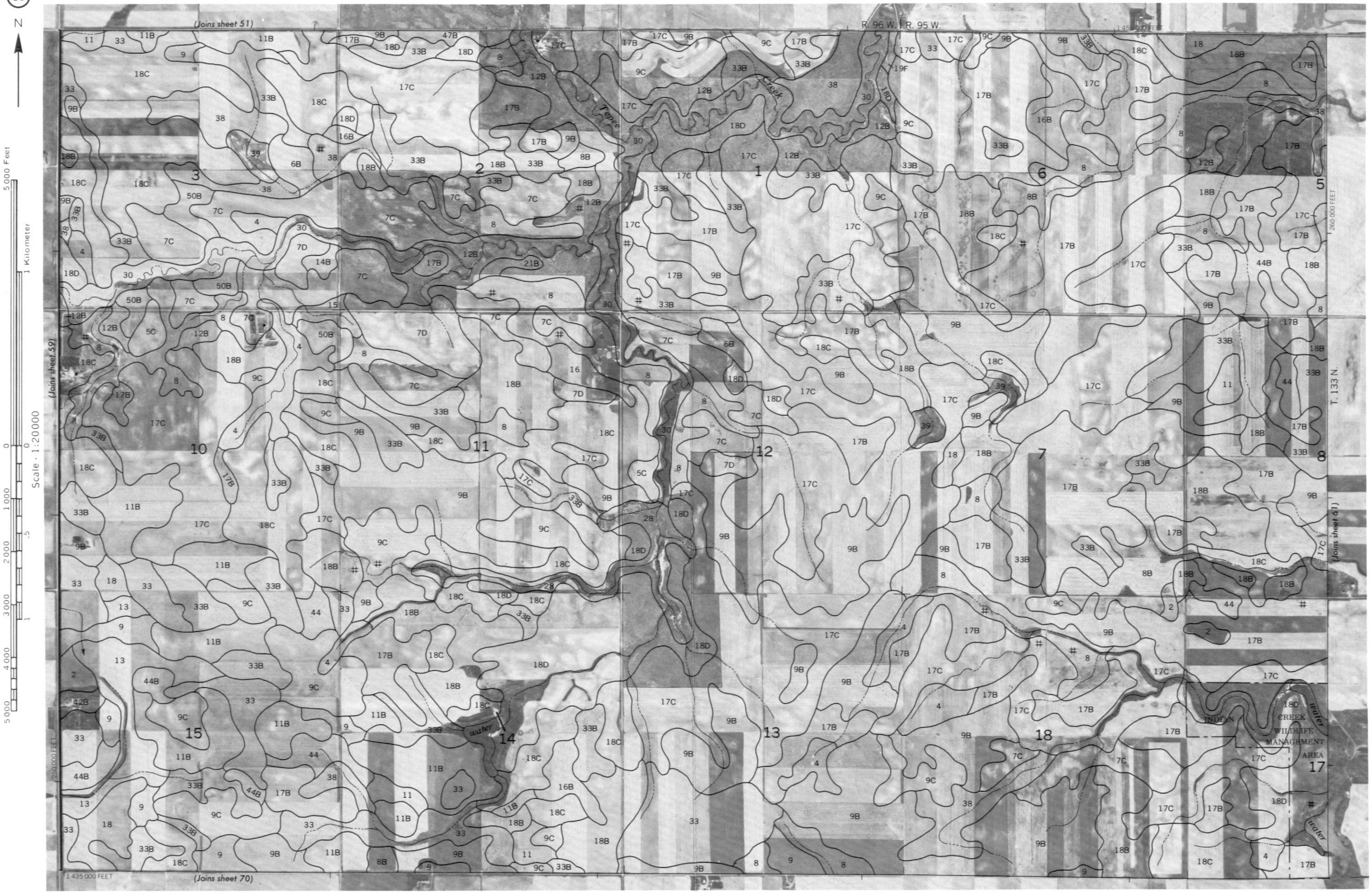

N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 46)
R. 92 W.
1 575 000 FEET
265 000 FEET
(Joins sheet 55)
(Joins sheet 57)
T. 134 N.
(Joins sheet 65)
1 555 000 FEET
Spring Creek
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

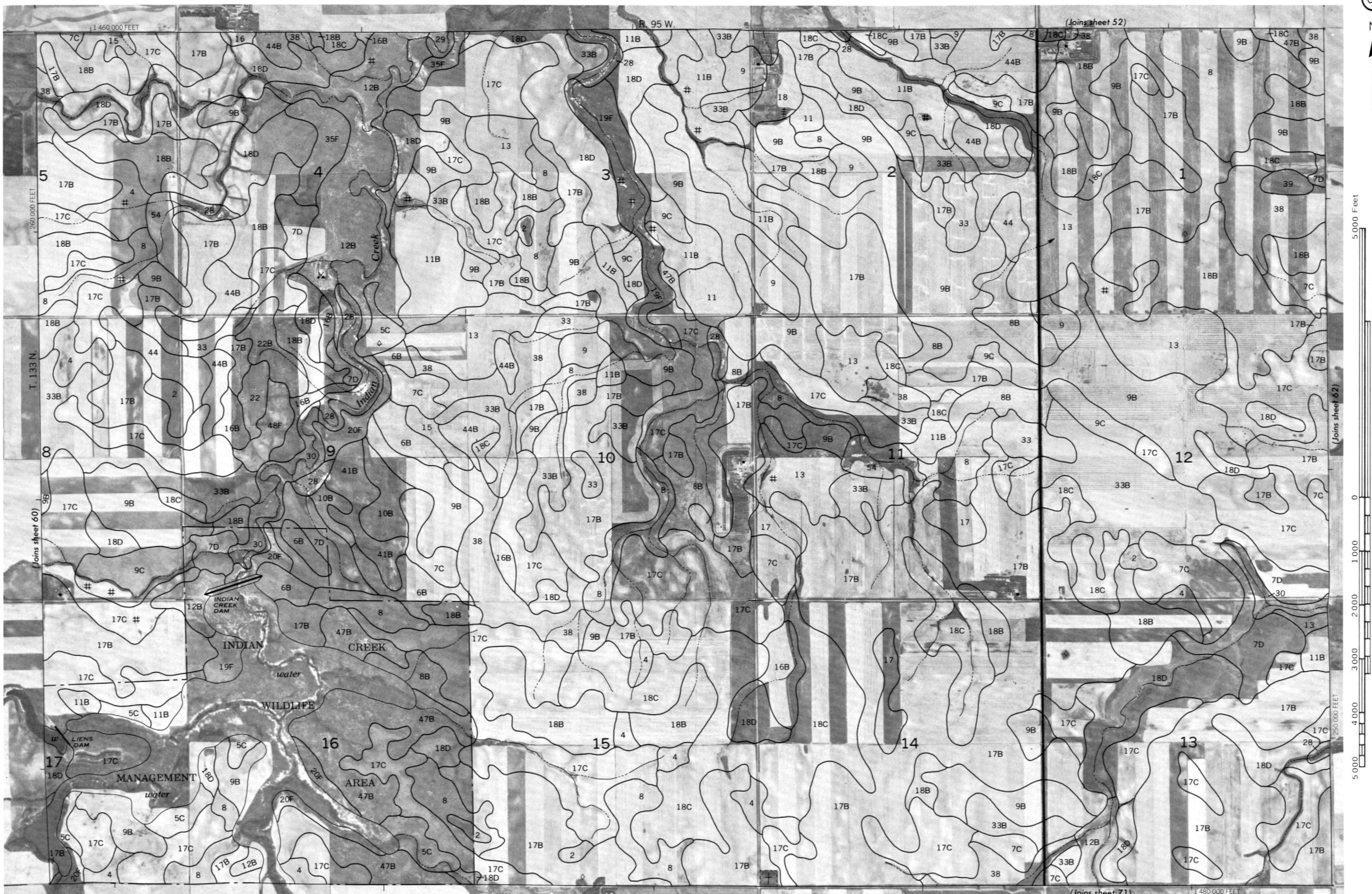


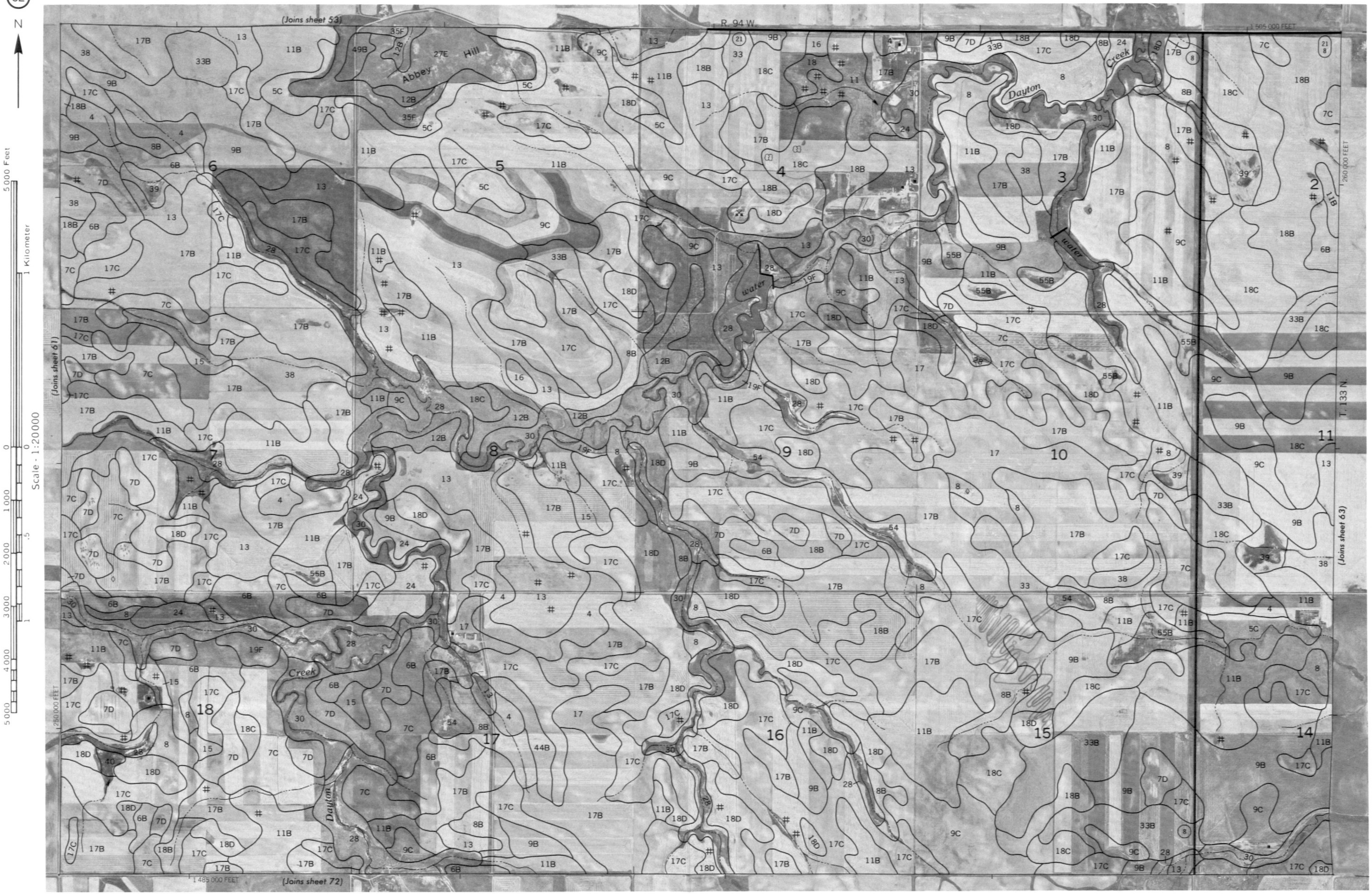
(Joins sheet 47)
R. 91 W.
1 580 000 FEET
T. 134 N.
(Joins sheet 56)
(Joins inset, sheet 48)
(Joins sheet 66)
1 600 000 FEET
Thirty Mile Creek
N
5 000 Feet
1 Kilometer
Scale - 1:20 000

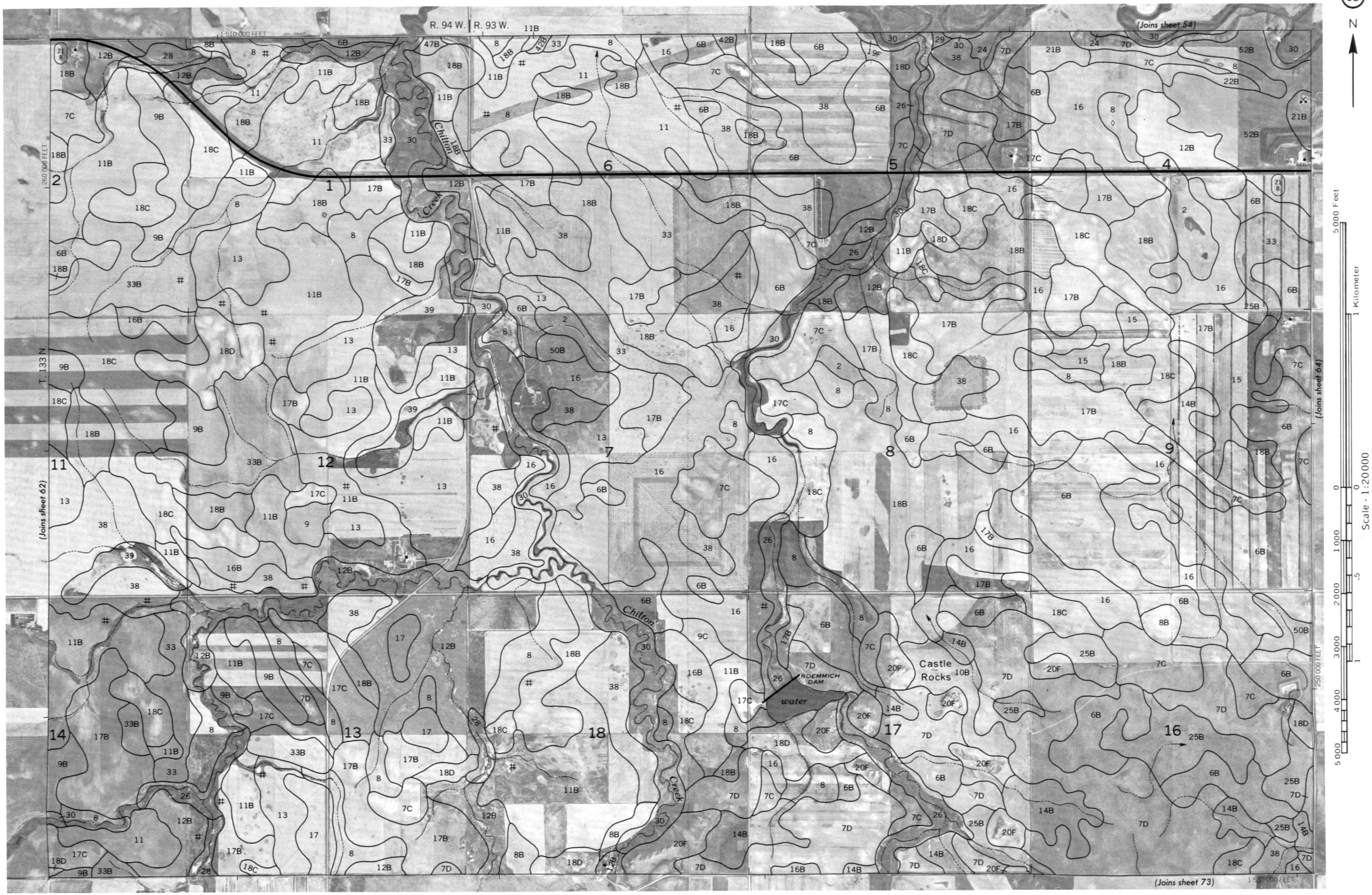

N
(Joins sheet 49)
R. 97 W.
Rustan Lake
Chanta
Peta
Creek
water
SLOPE COUNTY
T. 133 N.
(Joins sheet 59)
(Joins sheet 68)
1 410 000 FEET
1 390 000 FEET
280 000 FEET
260 000 FEET
5000 Feet
1 Kilometer
Scale - 1:20000


R. 97 W. | R. 96 W.
1 415 000 FEET
1 260 000 FEET
T. 133 N.
(Joins sheet 50)
(Joins sheet 60)
(Joins sheet 58)
(Joins sheet 69)
1 430 000 FEET
250 000 FEET
Chanta
Peta
Cr.
N
5 000 Feet
1 Kilometer
Scale - 1:20000

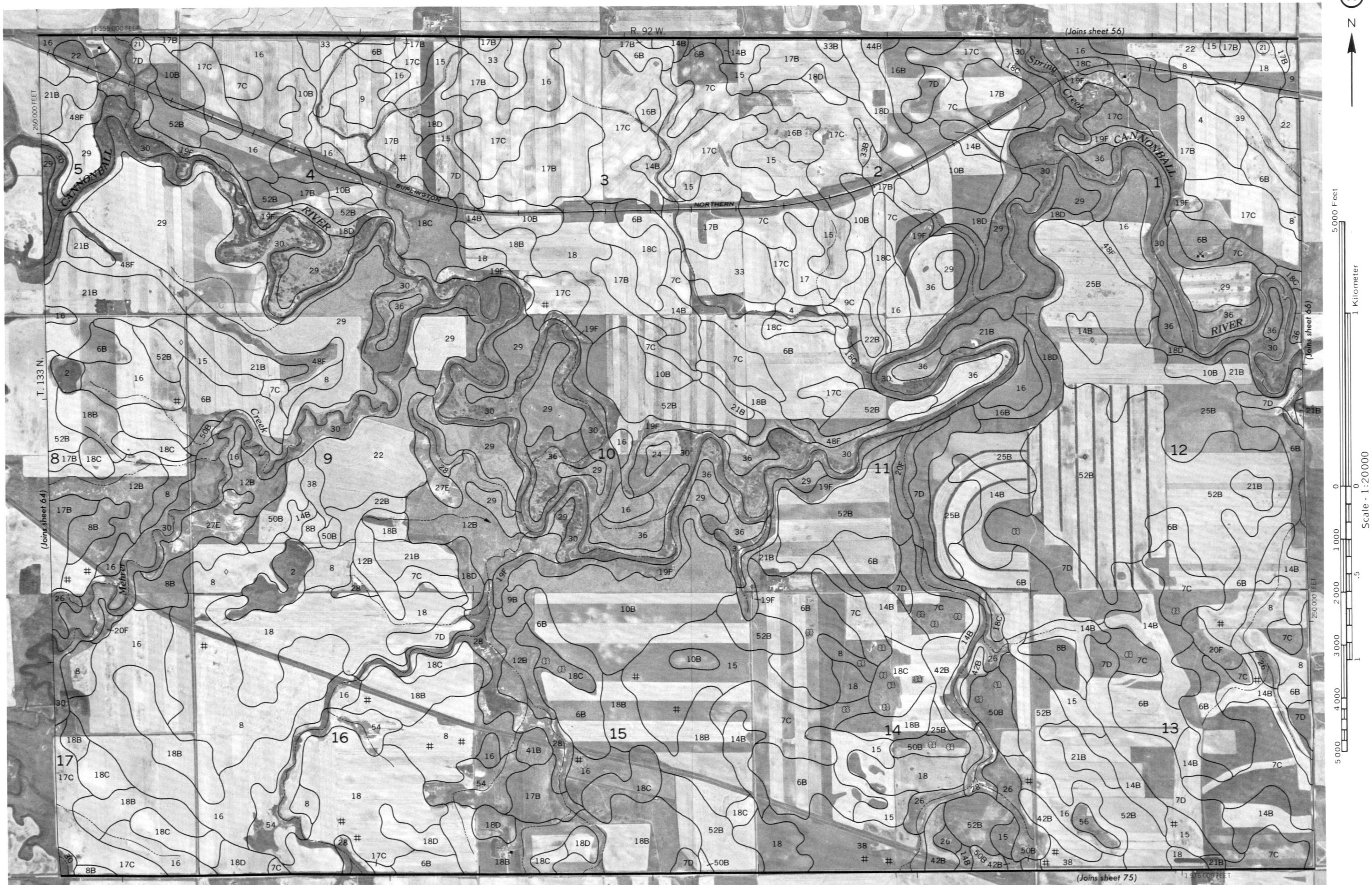

N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 51)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 70)
R. 96 W. | R. 95 W.
T. 133 N.
1 455 000 FEET
1 435 000 FEET
260 000 FEET
250 000 FEET
Tepee Creek
water
INDIAN CREEK WILDLIFE MANAGEMENT AREA
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18

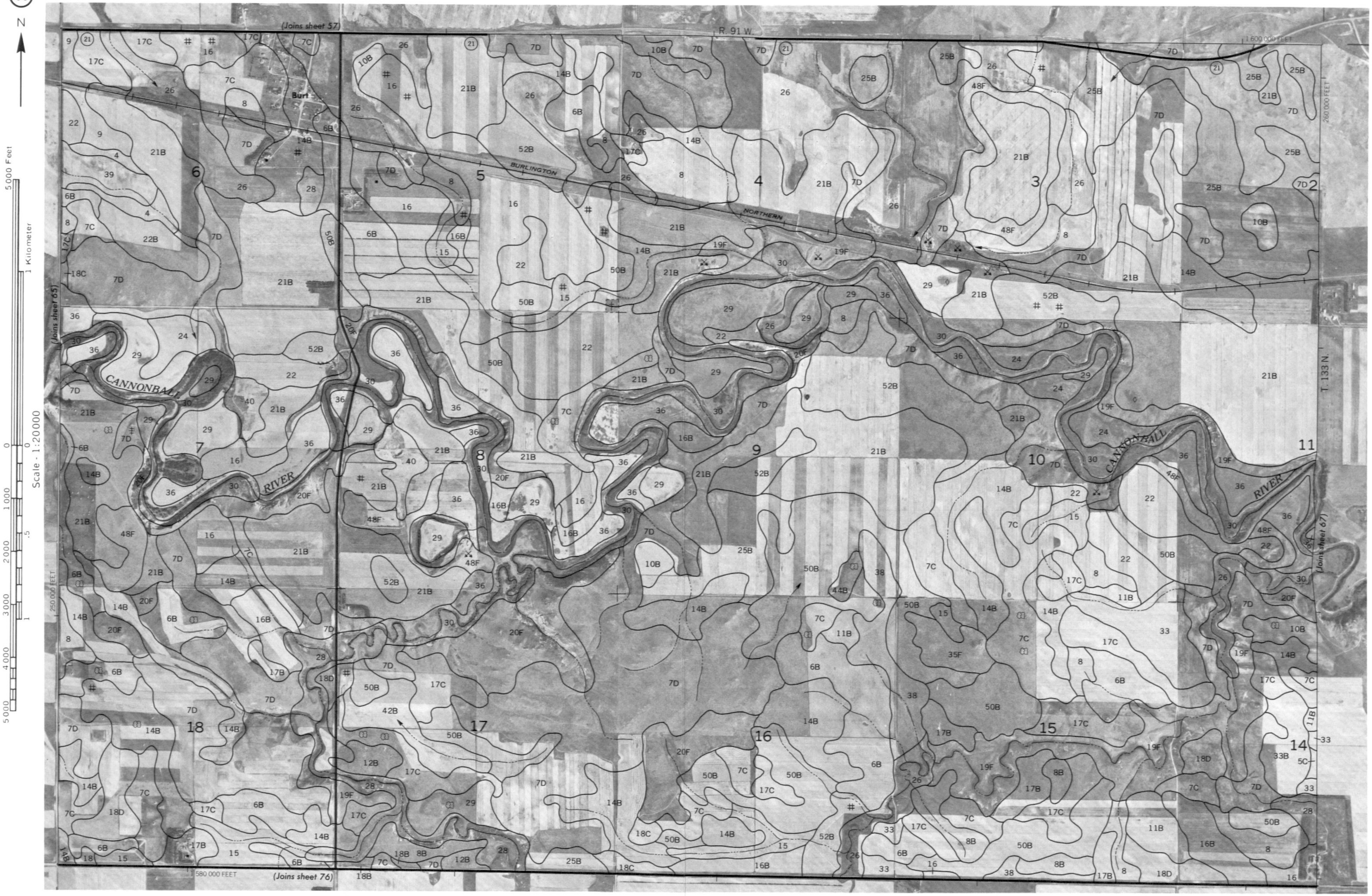

61
N
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 71)
1 460 000 FEET
1 480 000 FEET
260 000 FEET
250 000 FEET
R. 95 W.
T. 133 N.
Indian Creek
INDIAN CREEK DAM
LIENS DAM
INDIAN CREEK WILDLIFE MANAGEMENT AREA
water
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 53)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 72)
R. 94 W.
T. 133 N.
1 505 000 FEET
1 485 000 FEET
260 000 FEET
280 000 FEET
Abbey Hill
Dayton Creek
Creek
Dayton
water
water


63
N
R. 94 W.
R. 93 W.
T. 133 N.
1 510 000 FEET
260 000 FEET
250 000 FEET
1 550 000 FEET
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 64)
(Joins sheet 73)
Chilton Creek
Chilton Creek
Castle Rocks
ROEMMICH DAM
water
5000 Feet
1 Kilometer
Scale - 1:20000

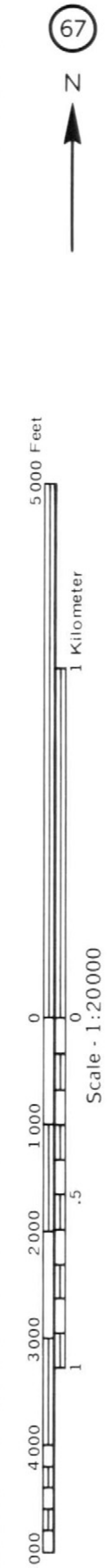

N
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1
(Joins sheet 55)
(Joins sheet 63)
(Joins sheet 65)
(Joins sheet 74)
MOTT
(county seat)
CANNONBALL
RIVER
LAGOON
WYMAN
AIRFIELD
Creek
Melroy
R. 93 W.
R. 92 W.
T. 133 N.
1 550 000 FEET
1 535 000 FEET
250 000 FEET
260 000 FEET

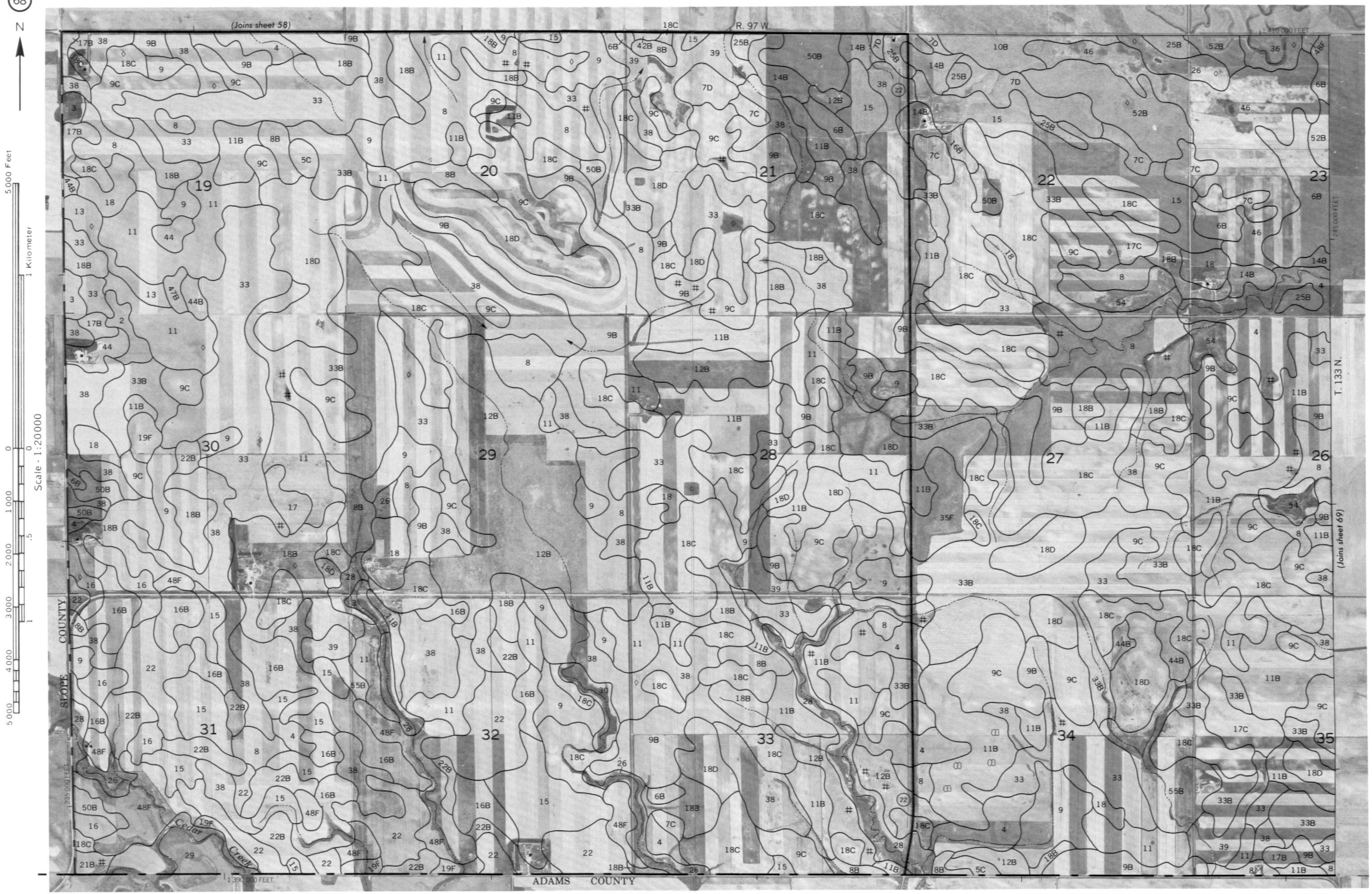

65
N
(Joins sheet 56)
R. 92 W.
T. 133 N.
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 75)
CANNONBALL RIVER
Spring Creek
Mehrer Creek
BURLINGTON NORTHERN
5000 Feet
1 Kilometer
Scale - 1:20000

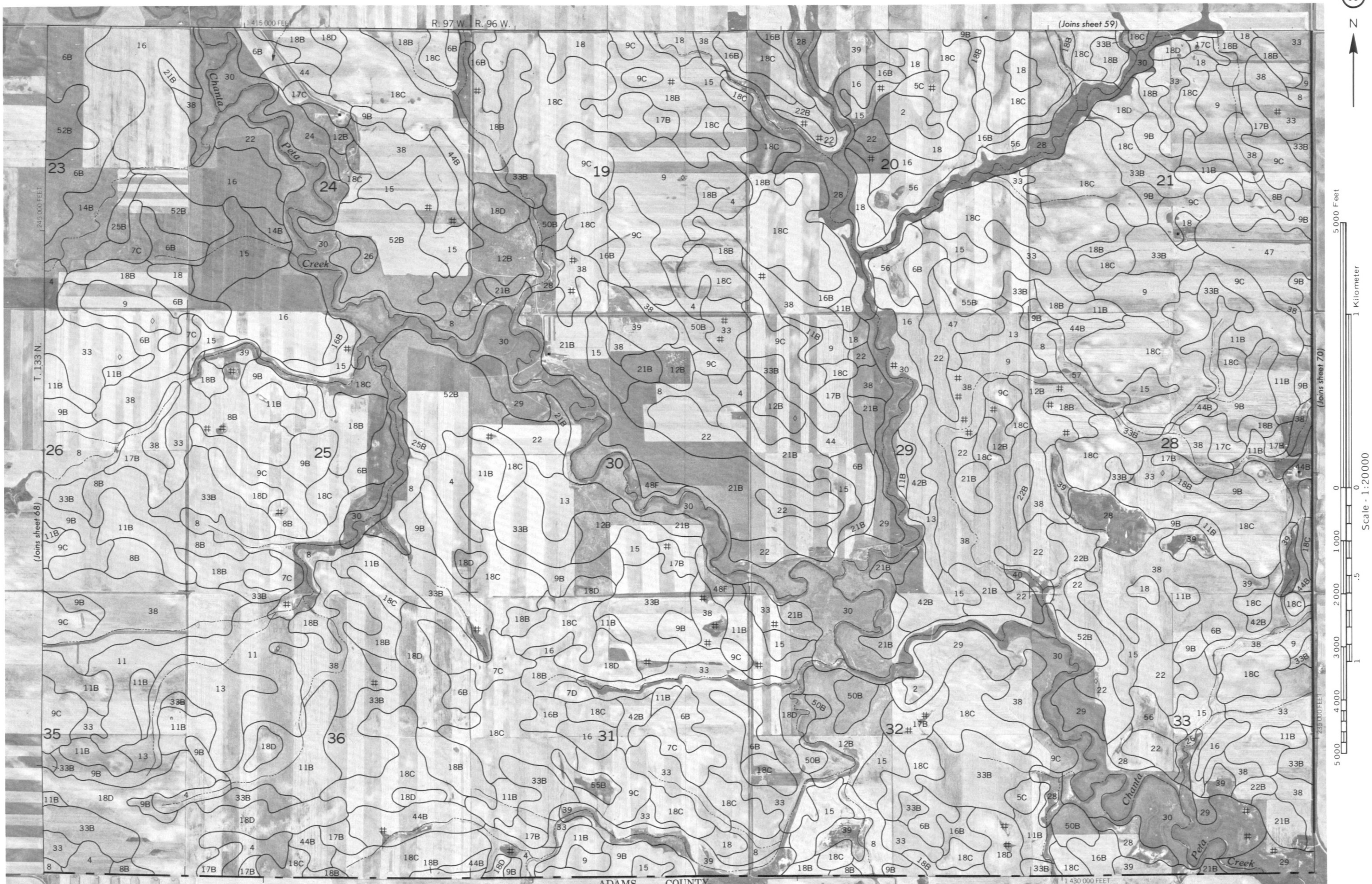

N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 57)
R. 91 W.
1 600 000 FEET
260 000 FEET
Burt
BURLINGTON
NORTHERN
CANNONBALL
RIVER
CANNONBALL
RIVER
T. 133 N.
(Joins sheet 65)
(Joins sheet 67)
250 000 FEET
580 000 FEET
(Joins sheet 76)


R. 91 W.
(Joins inset, sheet 48)
1 605 000 FEET
260 000 FEET
T. 133 N.
(Joins sheet 66)
NORTHERN
BURLINGTON
Thirty
Mile
Creek
RIVER
CANNONBALL
GRANT
COUNTY
BENTLEY CEMETERY
Bentley
(Joins upper right)
1 610 000 FEET
245 000 FEET

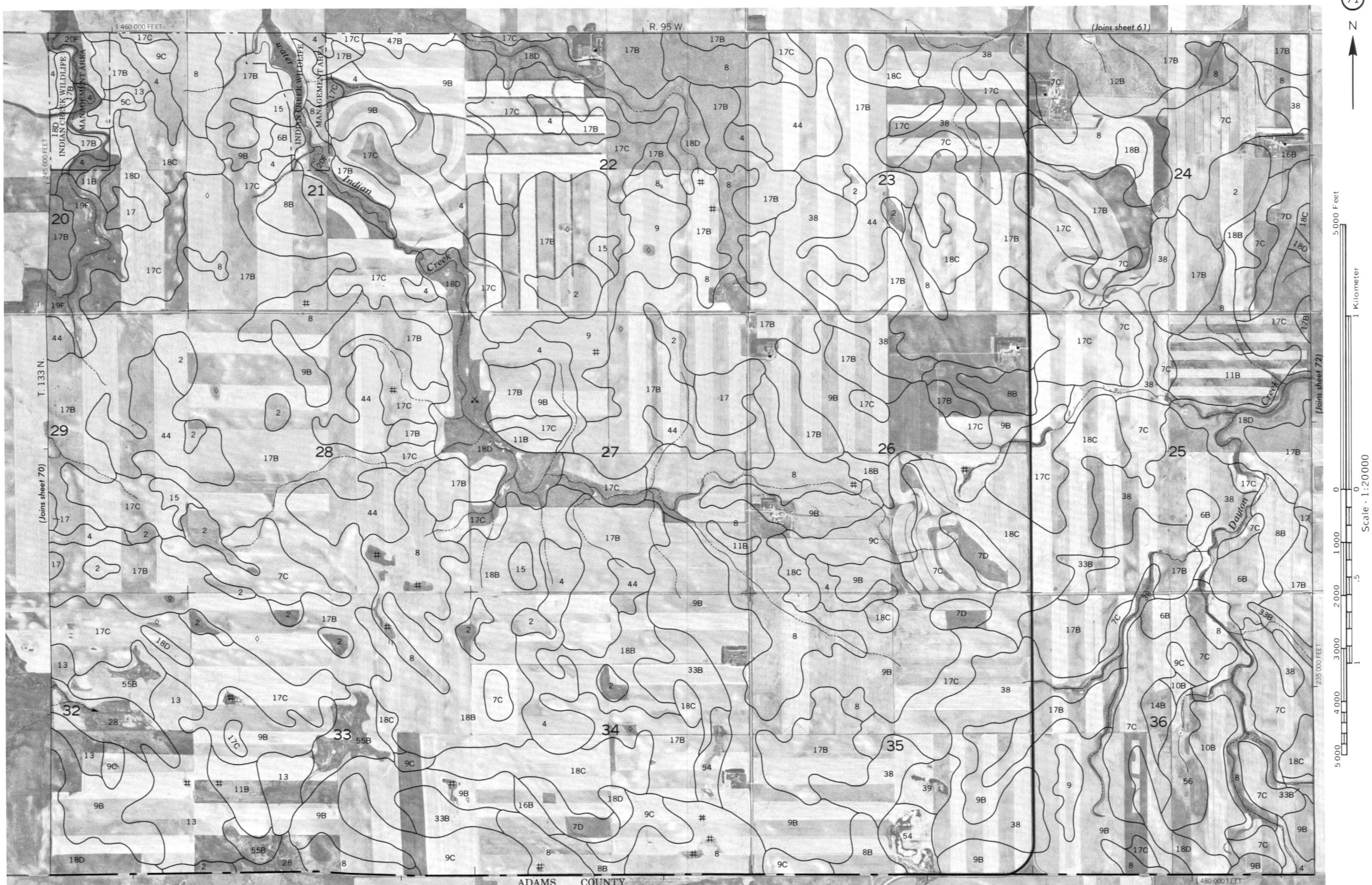

R. 91 W.
1 605 000 FEET
(Joins lower left)
240 000 FEET
T. 133 N.
(Joins sheet 76)
GRANT
COUNTY
(Joins sheet 81)
1 610 000 FEET
230 000 FEET

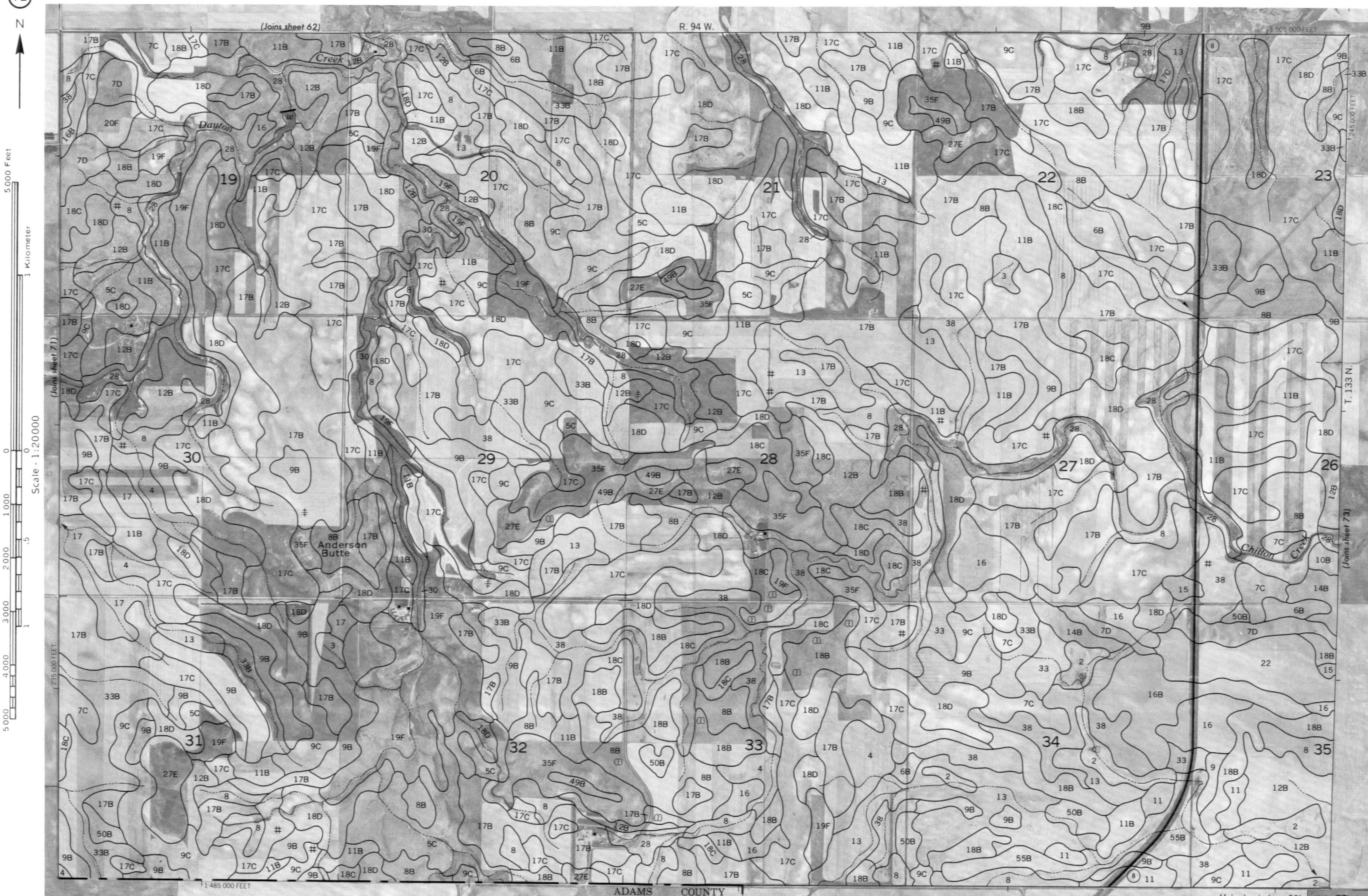

67
N
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 58)
R. 97 W.
T. 133 N.
(Joins sheet 69)
SLOPE COUNTY
ADAMS COUNTY
Cedar Creek
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
1 390 000 FEET
245 000 FEET
235 000 FEET

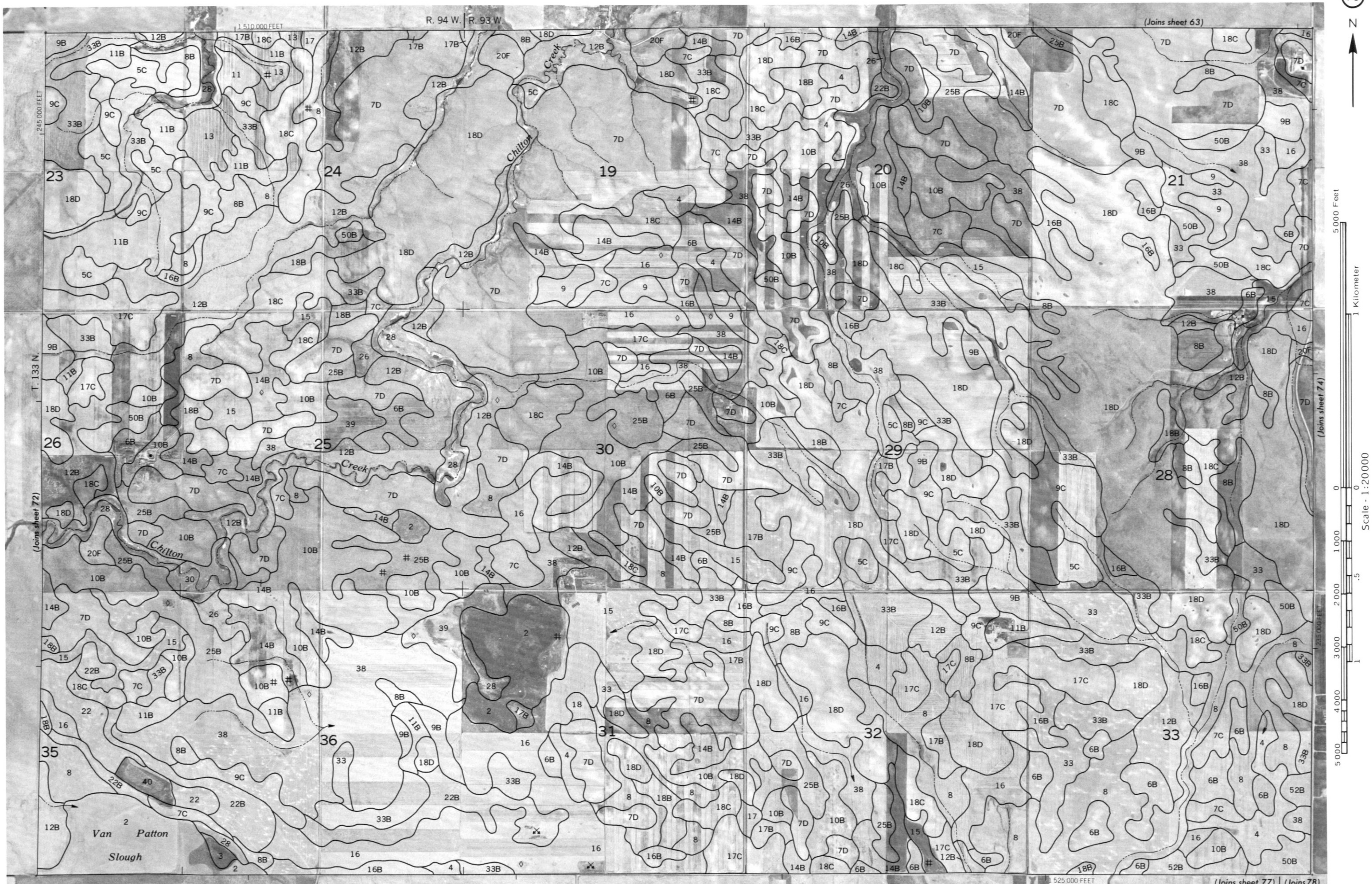

(Joins sheet 59)
R. 97 W.
R. 96 W.
T. 133 N.
(Joins sheet 68)
(Joins sheet 70)
ADAMS COUNTY
Chanta
Peta Creek
N
5000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 60)
R. 96 W.
R. 95 W.
1 455 000 FEET
(Joins sheet 69)
(Joins sheet 71)
T. 133 N.
245 000 FEET
235 000 FEET
1 440 000 FEET
ADAMS COUNTY
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36

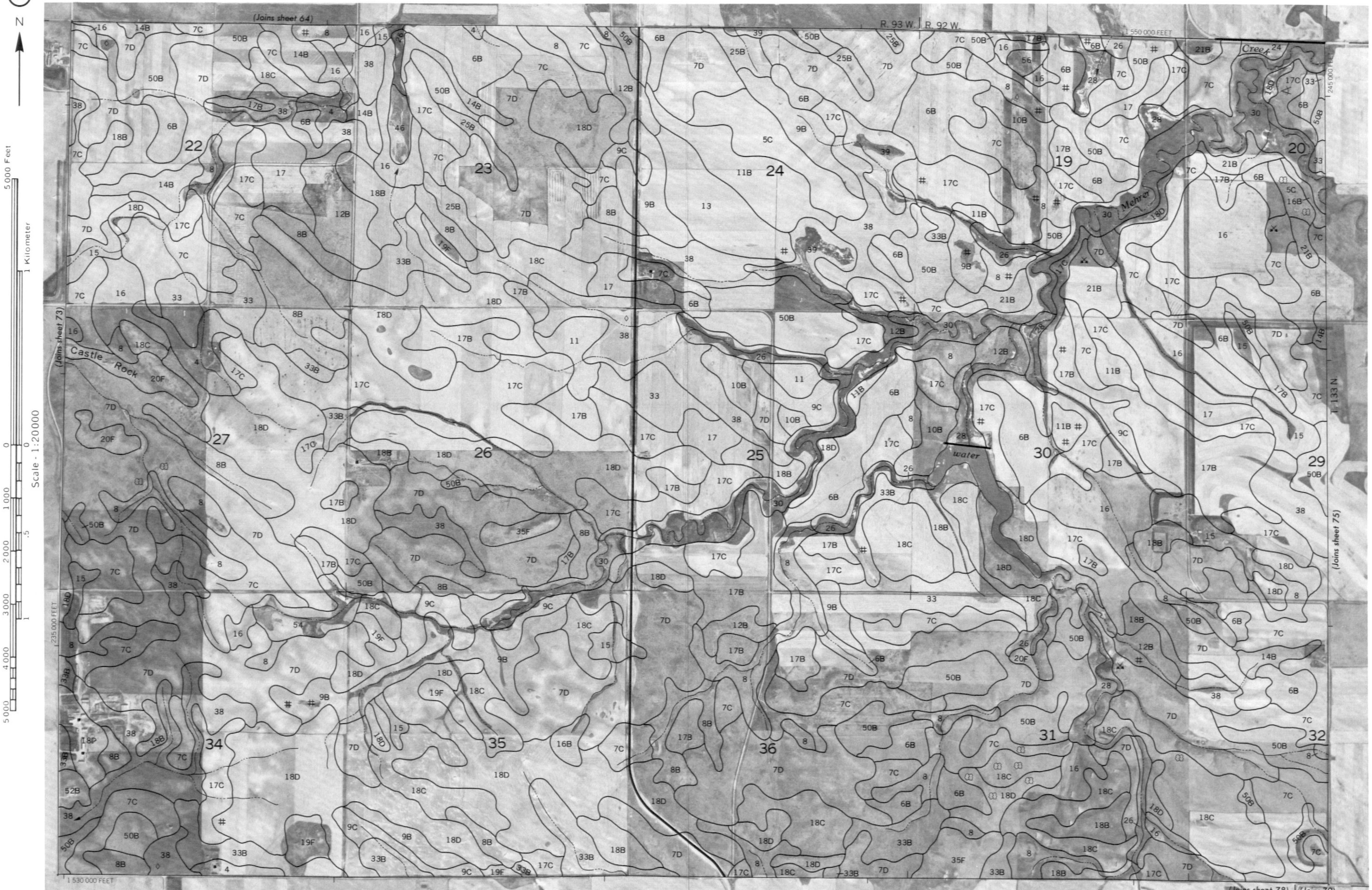

71
N
(Joins sheet 61)
R. 95 W.
1 460 000 FEET
245 000 FEET
INDIAN CREEK WILDLIFE MANAGEMENT AREA
INDIAN CREEK WILDLIFE MANAGEMENT AREA
Indian Creek
T. 133 N.
(Joins sheet 70)
(Joins sheet 72)
Creek
Dayton
235 000 FEET
480 000 FEET
ADAMS COUNTY
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
5000 Feet
1 Kilometer
Scale - 1:20000

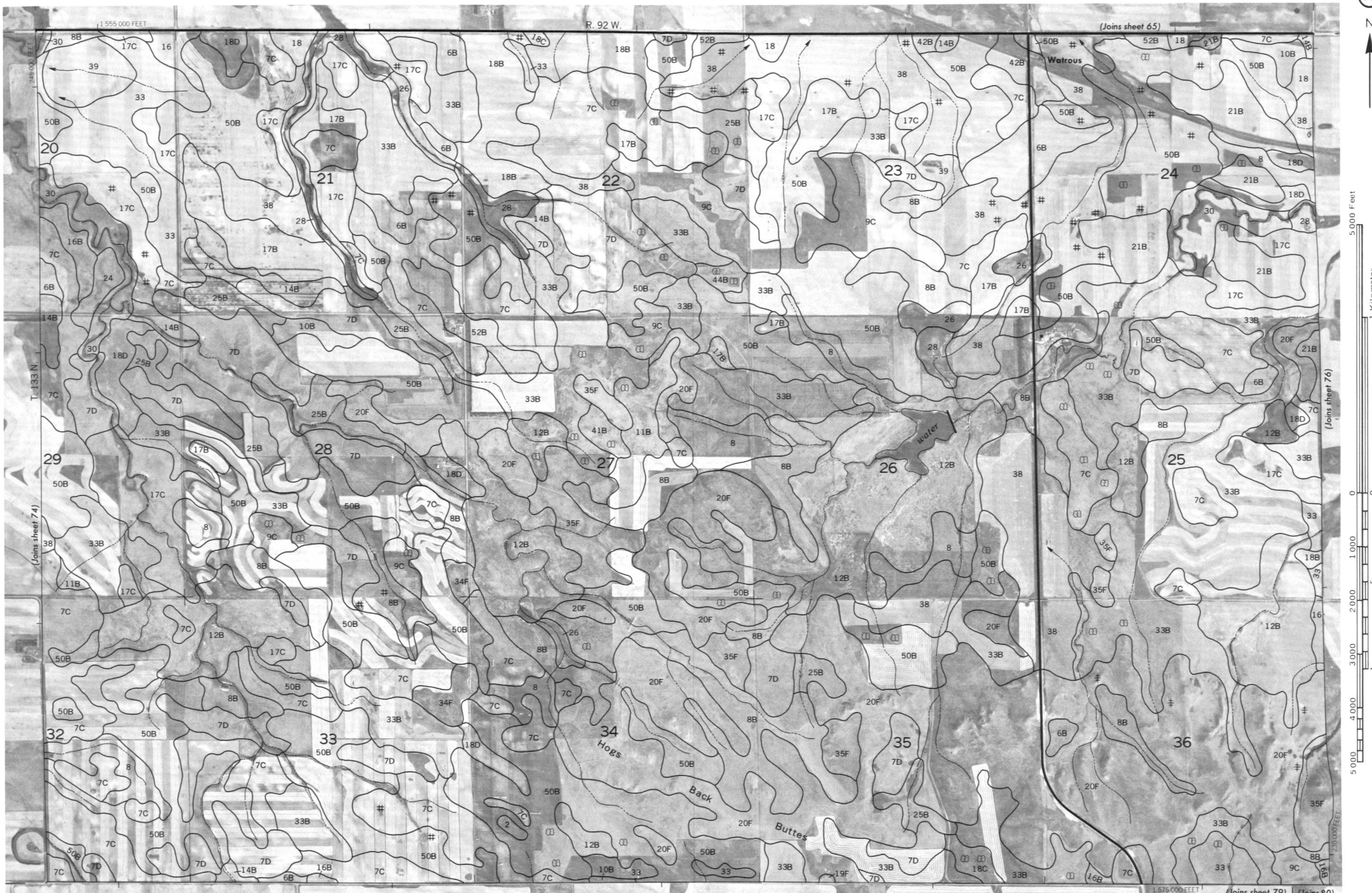

N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 62)
R. 94 W.
1 505 000 FEET
245 000 FEET
235 000 FEET
1 485 000 FEET
T. 133 N.
(Joins sheet 71)
(Joins sheet 73)
(Joins inset, sheet 82)
(Joins 77)
ADAMS COUNTY
Creek
Dayton
Anderson Butte
Chilton Creek
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

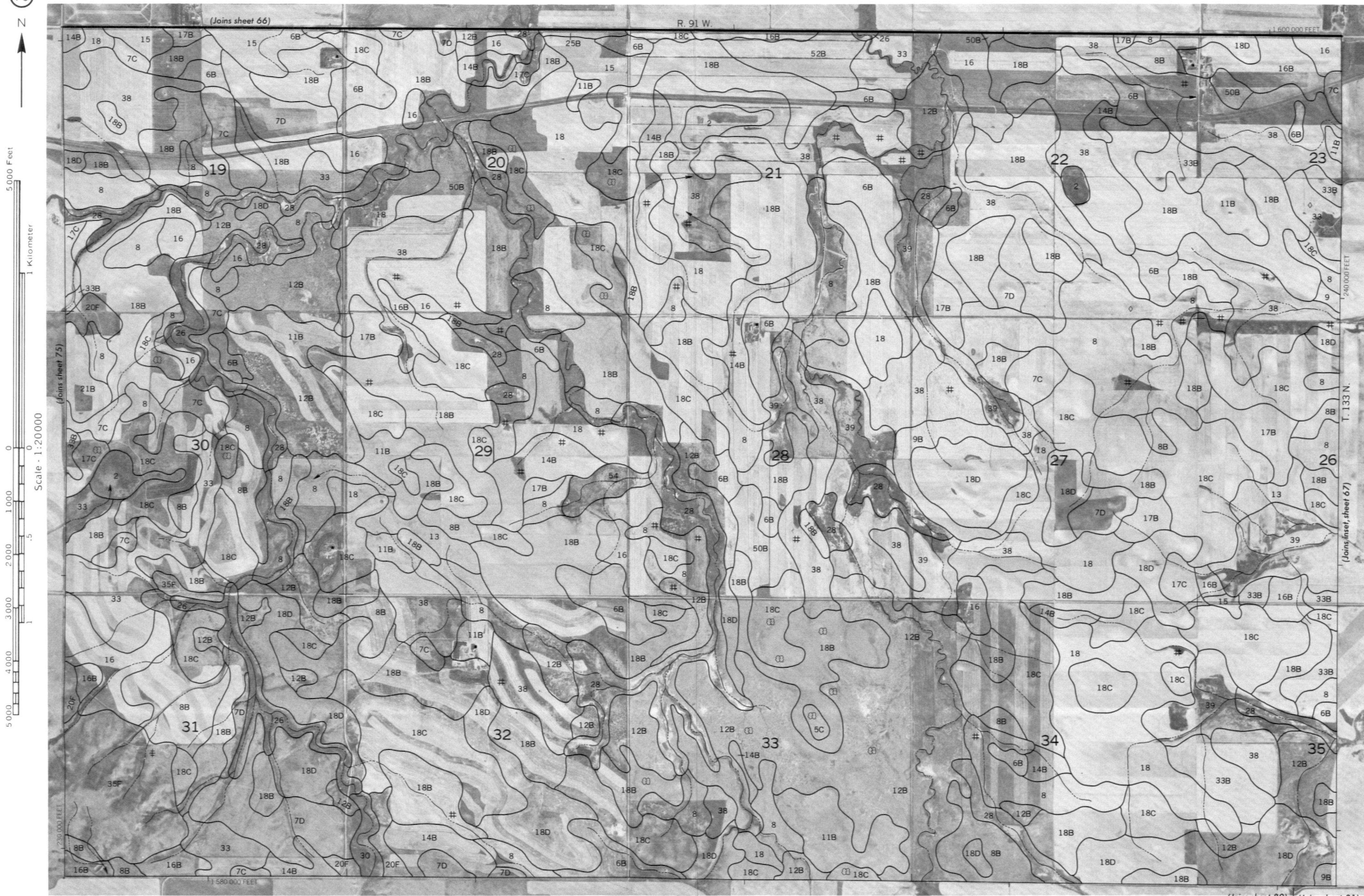
HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 73

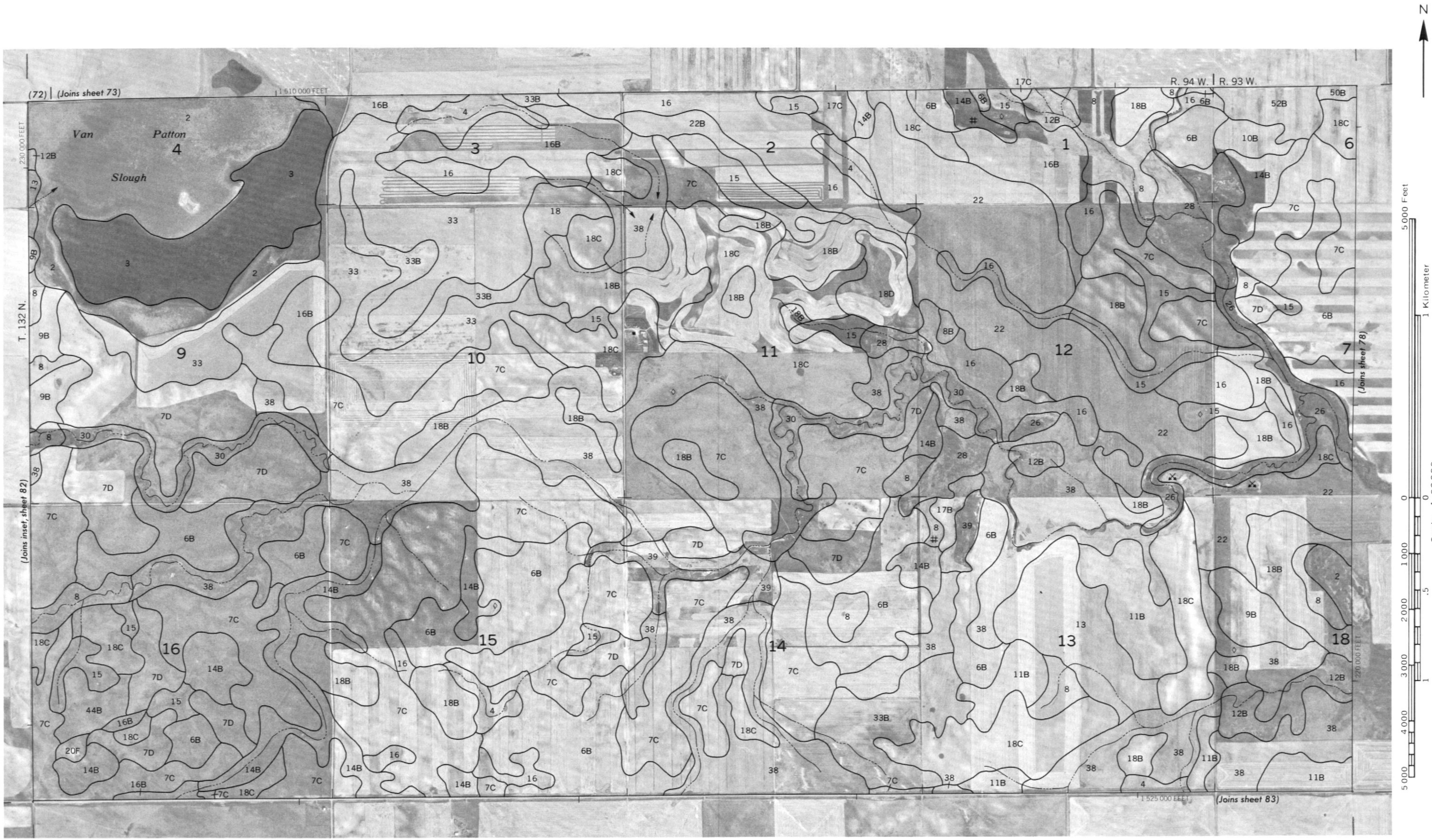


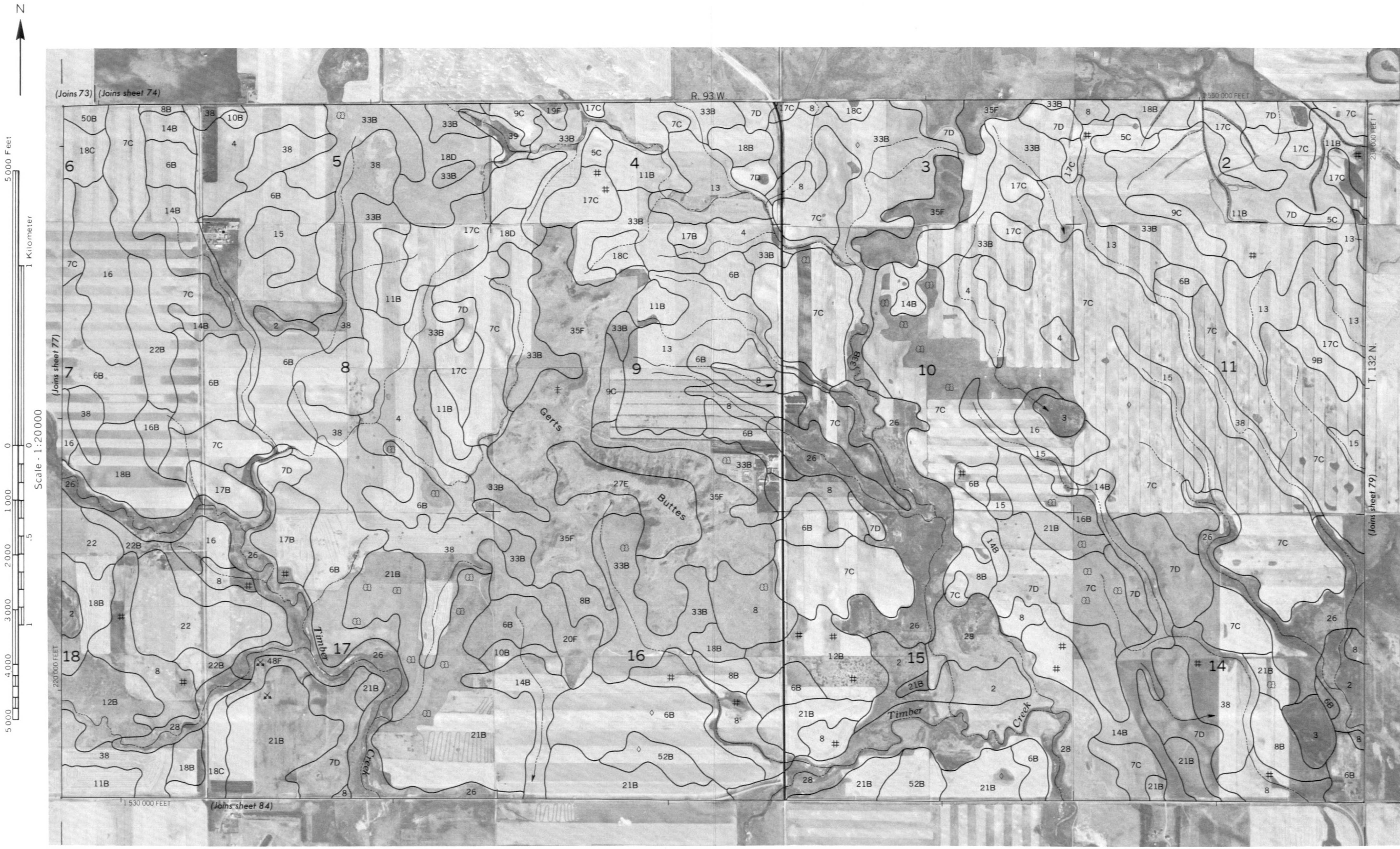
HETTINGER COUNTY, NORTH DAKOTA — SHEET NUMBER 74

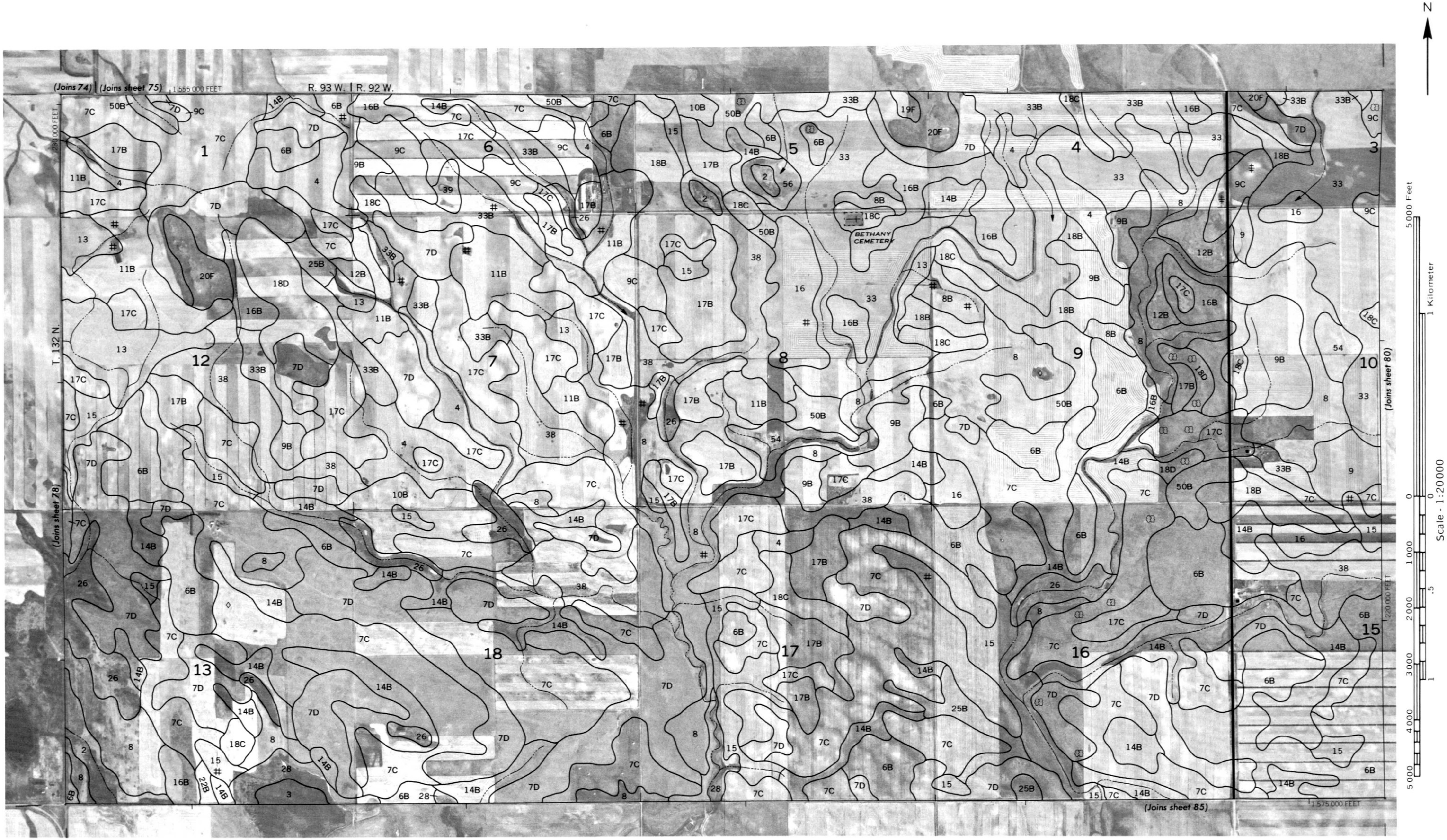


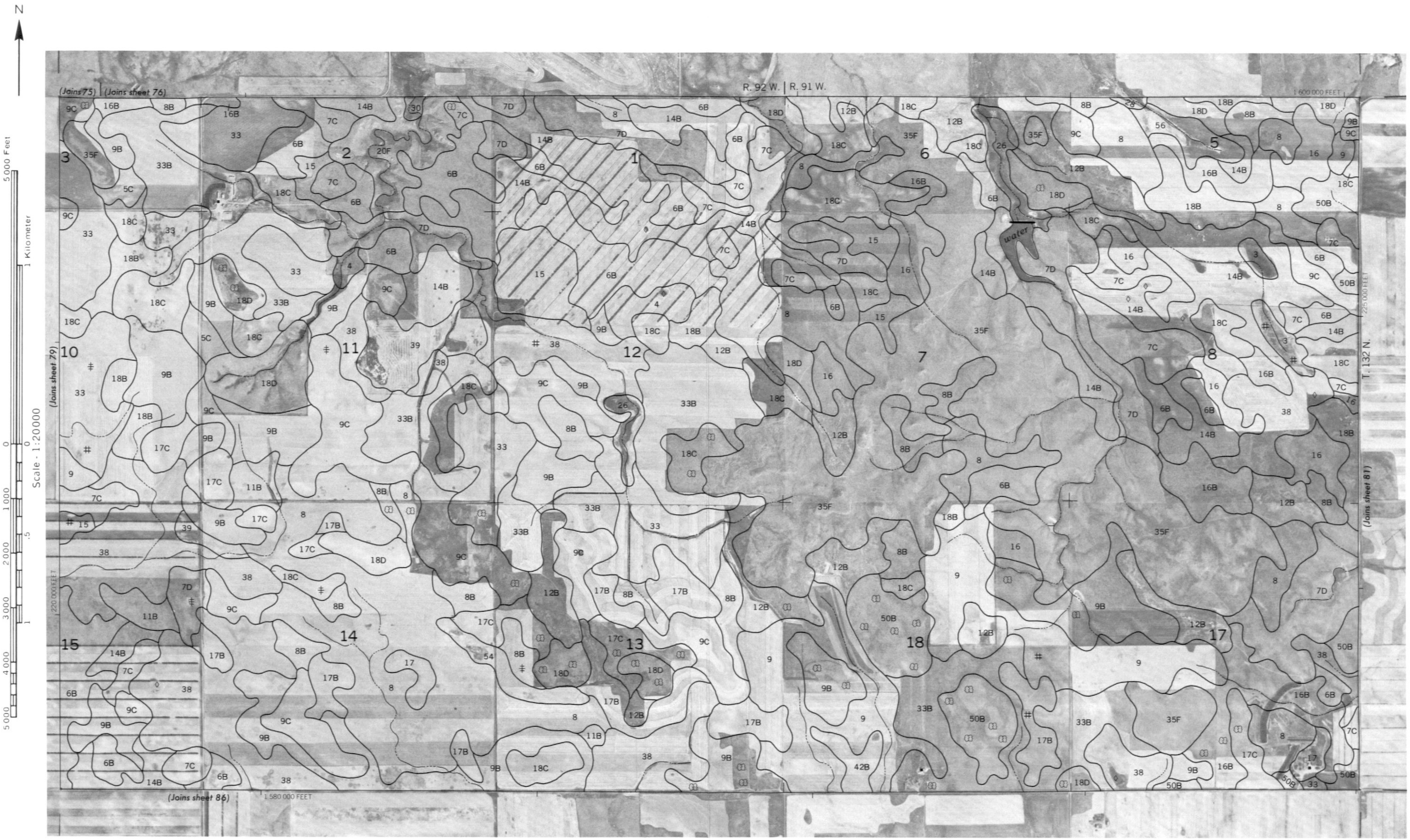

R. 92 W.
T. 133 N.
1 555 000 FEET
245 000 FEET
1 575 000 FEET
230 000 FEET
(Joins sheet 65)
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 79)
(Joins 80)
Watrous
water
Hogs Back Buttes
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
N
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
0
.5
1


N
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
0
.5
1
(Joins sheet 66)
R. 91 W.
1 600 000 FEET
240 000 FEET
T. 133 N.
(Joins sheet 75)
(Joins inset, sheet 67)
230 000 FEET
1 580 000 FEET
(Joins sheet 80)
(Joins sheet 81)
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

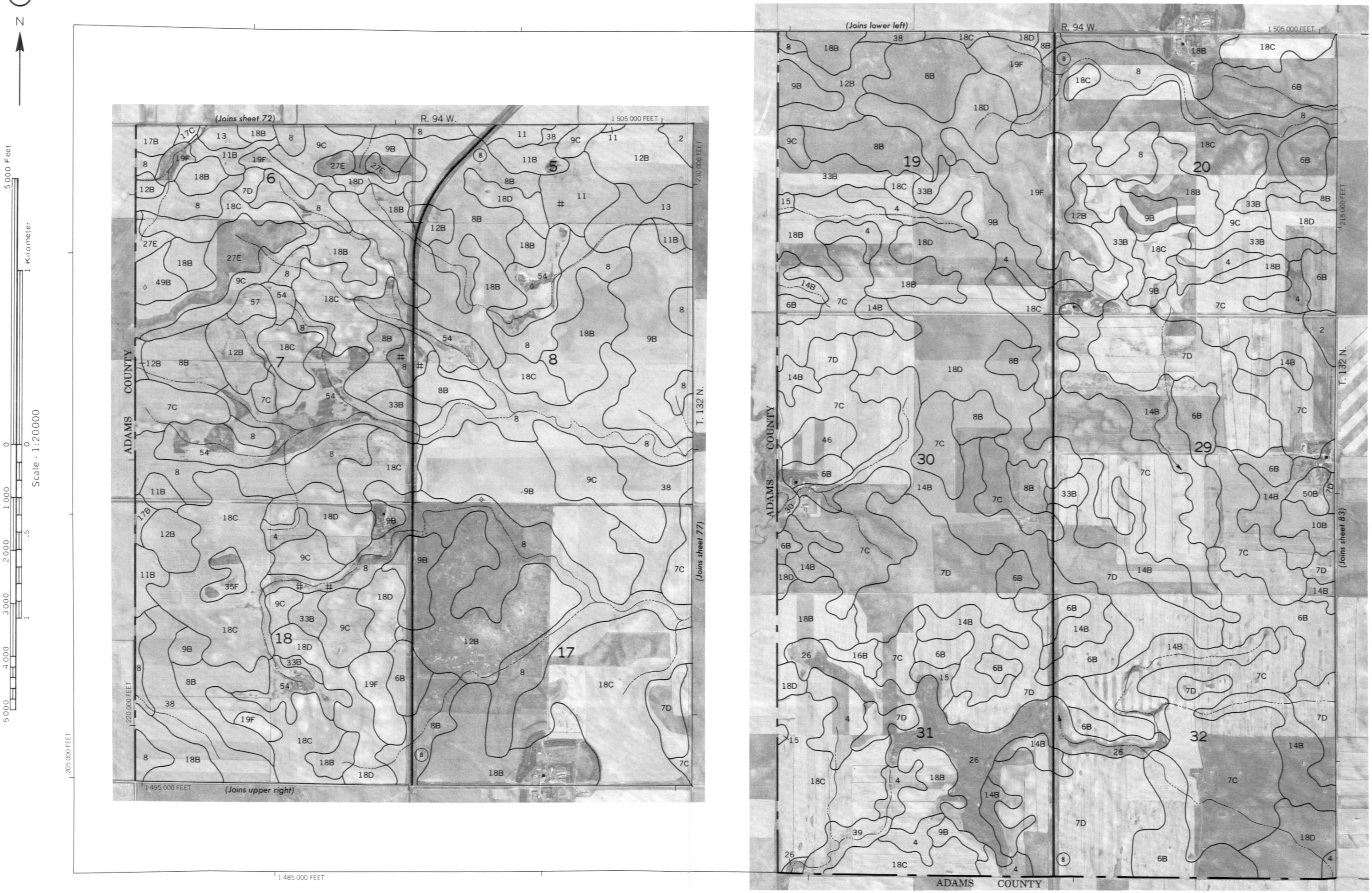

N
(72) (Joins sheet 73)
1 510 000 FEET
230 000 FEET
Van Patton Slough
R. 94 W. | R. 93 W.
T. 132 N.
(Joins sheet 78)
(Joins inset, sheet 82)
(Joins sheet 83)
1 525 000 FEET
220 000 FEET
5000 Feet
1 Kilometer
Scale - 1:20000

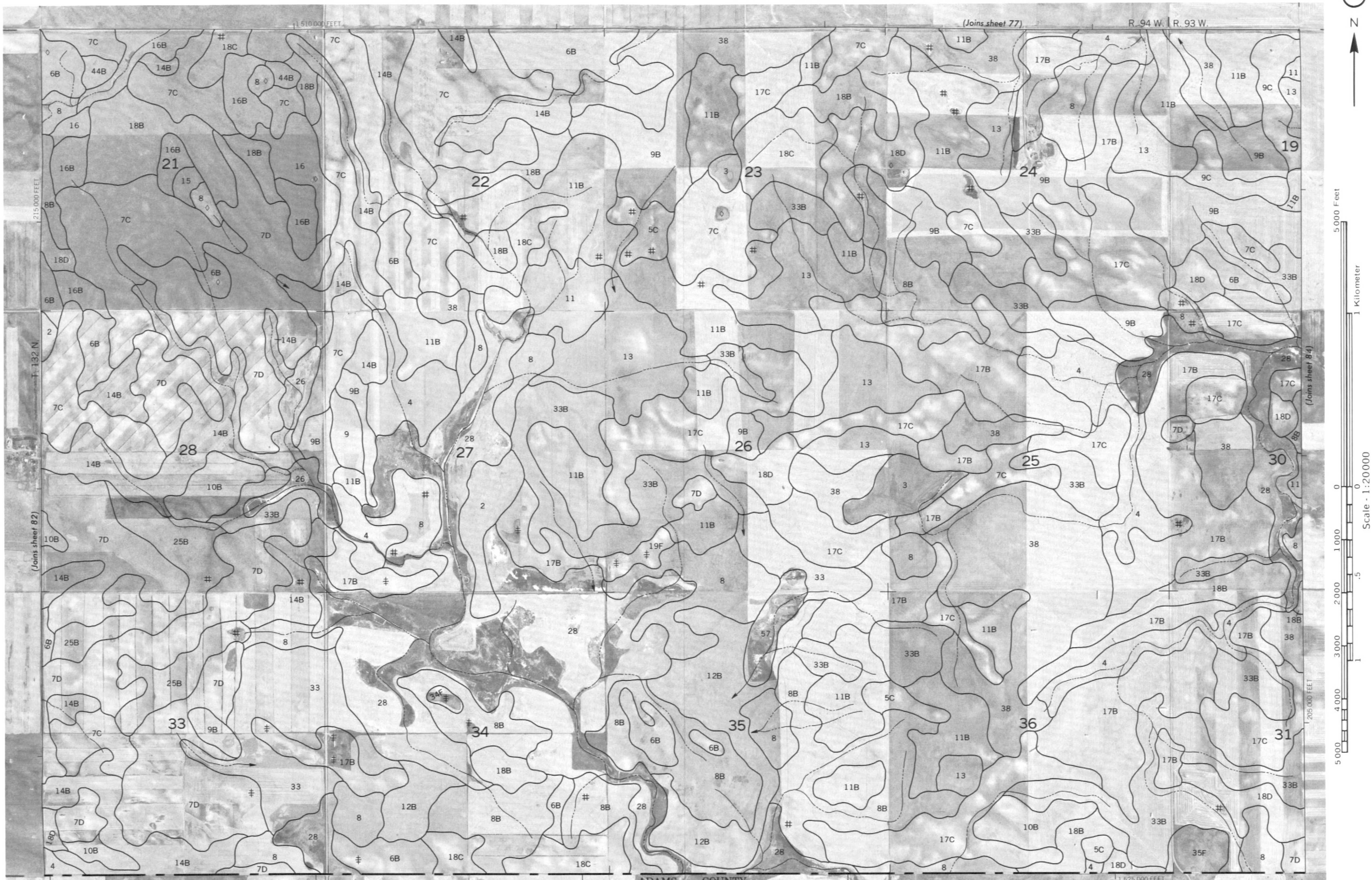

N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins 73)
(Joins sheet 74)
R. 93 W.
T. 132 N.
(Joins sheet 77)
(Joins sheet 79)
(Joins sheet 84)
1 530 000 FEET
1 550 000 FEET
220 000 FEET
Gerts
Buttes
Timber
Creek
Timber
Creek
6
5
4
3
2
7
8
9
10
11
18
17
16
15
14


N
(Joins 74)
(Joins sheet 75)
1 555 000 FEET
R. 93 W.
R. 92 W.
230 000 FEET
T. 132 N.
(Joins sheet 78)
(Joins sheet 80)
(Joins sheet 85)
1 575 000 FEET
220 000 FEET
BETHANY CEMETERY
5000 Feet
1 Kilometer
Scale - 1:20000

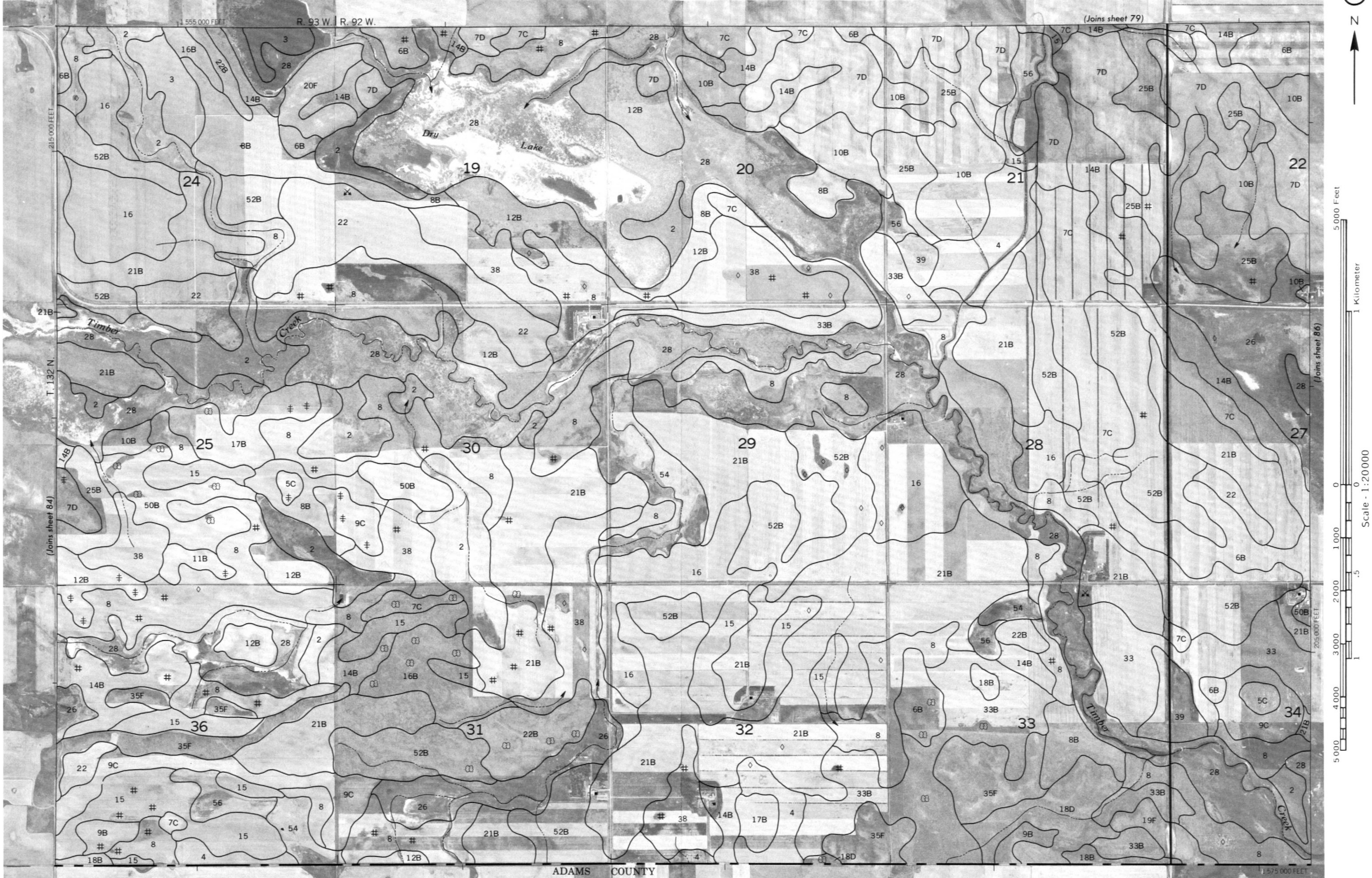

N
5 000 Feet
1 Kilometer
Scale 1:20000
(Joins 75)
(Joins sheet 76)
R. 92 W. | R. 91 W.
1 600 000 FEET
(Joins sheet 79)
(Joins sheet 81)
T. 132 N.
225 000 FEET
220 000 FEET
(Joins sheet 86)
1 580 000 FEET
water

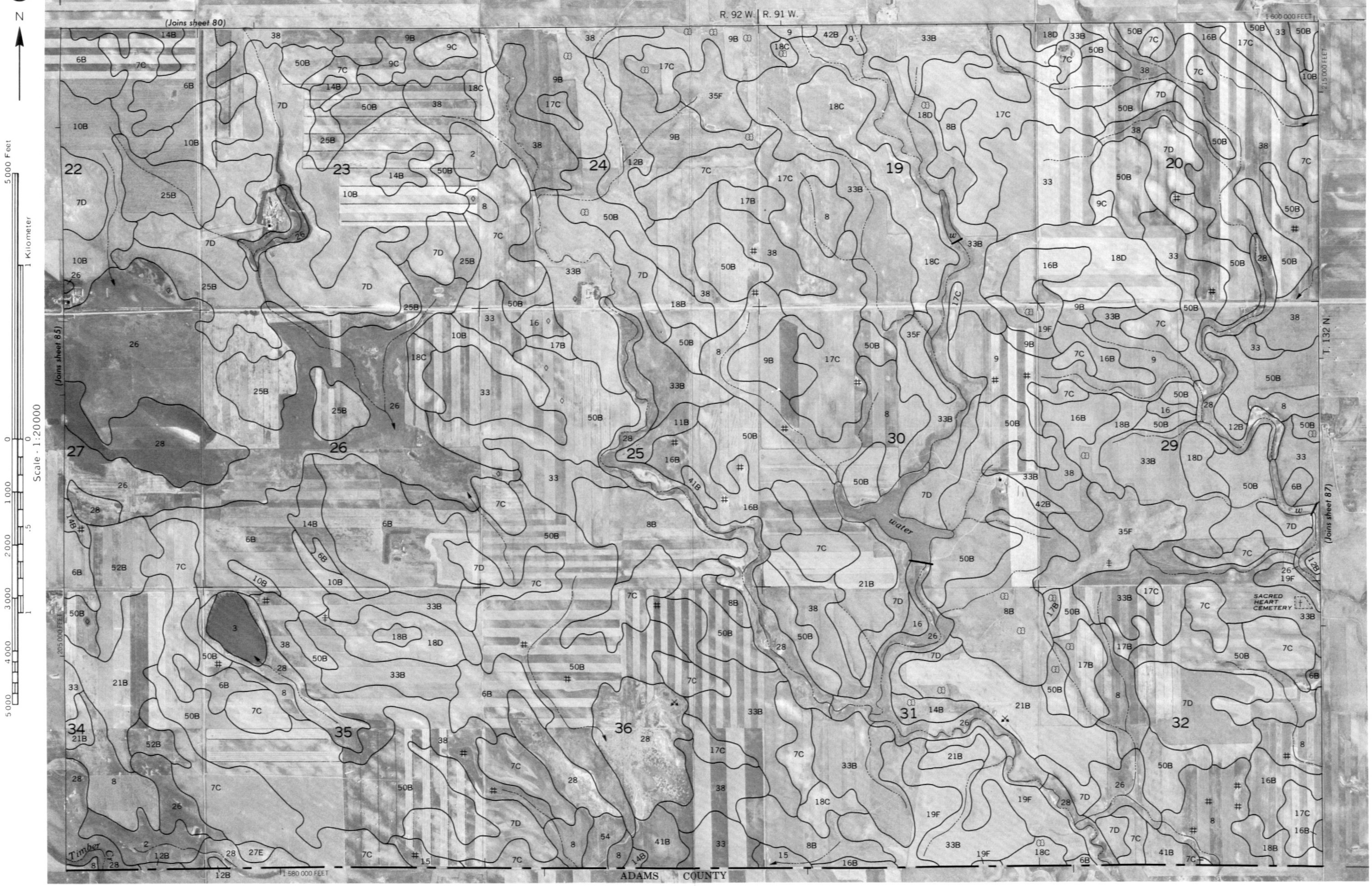

N
(Joins 76)
(Joins inset, sheet 67)
1 605 000 FEET
GRANT COUNTY
R. 91 W.
T. 132 N.
225 000 FEET
(Joins sheet 80)
KILZER DAM
water
GRANT COUNTY
220 000 FEET
(Joins sheet 87)
1 620 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000

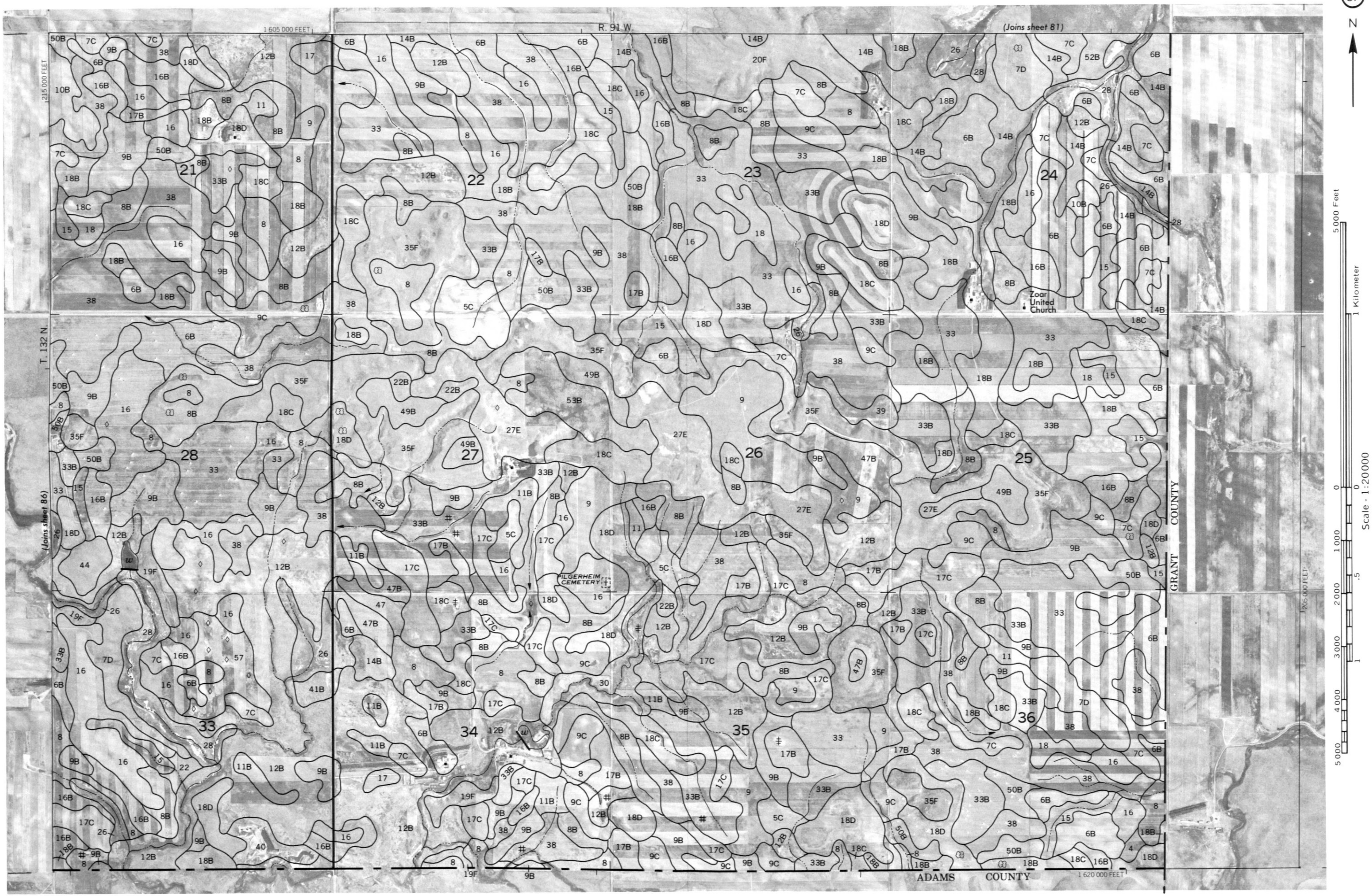

N
5 000 Feet
1 Kilometer
Scale - 1:20 000
(Joins sheet 72)
R. 94 W.
1 505 000 FEET
230 000 FEET
T. 132 N.
(Joins sheet 77)
ADAMS COUNTY
220 000 FEET
205 000 FEET
1 495 000 FEET
(Joins upper right)
1 485 000 FEET
(Joins lower left)
215 000 FEET
(Joins sheet 83)


(Joins sheet 77)
R. 94 W.
R. 93 W.
1 510 000 FEET
215 000 FEET
T. 132 N.
(Joins sheet 82)
(Joins sheet 84)
205 000 FEET
1 525 000 FEET
ADAMS COUNTY
N
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1


N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 78)
R. 93 W.
1 550 000 FEET
215 000 FEET
Timber Creek
Timber Creek
Timber Creek
T. 132 N.
(Joins sheet 83)
(Joins sheet 85)
205 000 FEET
1 530 000 FEET
ADAMS COUNTY


N
R. 93 W. | R. 92 W.
1 555 000 FEET
215 000 FEET
T. 132 N.
(Joins sheet 79)
(Joins sheet 84)
(Joins sheet 86)
Dry Lake
Timber Creek
Timber
Creek
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
ADAMS COUNTY
205 000 FEET
1 575 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 80)
(Joins sheet 85)
(Joins sheet 87)
R. 92 W.
R. 91 W.
T. 132 N.
1 600 000 FEET
1 580 000 FEET
205 000 FEET
215 000 FEET
SACRED HEART CEMETERY
water
Timber Cr.
ADAMS COUNTY


87
N
R. 91 W.
(Joins sheet 81)
1 605 000 FEET
215 000 FEET
T. 132 N.
(Joins sheet 86)
Zoar United Church
PILGERHEIM CEMETERY
GRANT COUNTY
ADAMS COUNTY
1 620 000 FEET
205 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000